EEI BULLETIN

• JULY-AUGUST, 1960 •

Current EEI Research Projects

H. P. Seelye

Dollar Savings in Fire Insurance Valuations

G. G. Blair

Remote Reading of Electric and Gas Meters

L. W. Garrand

Fatal Accidents in 1959

S. H. Young

PUBLISHED BY EDISON ELECTRIC INSTITUTE

ELECTRIC UTILITY INDUSTRY Statistics IN THE UNITED STATES

for APRIL 1960

Current Statistical Data Covering 100 Percent of Industry

(Includes Investor-Owned Companies, Cooperatives, and Government-Owned Utilities) — April, 1960

	1960	1959	%
SOURCE AND DISPOSAL OF ENERGY			
NET GENERATION* (Kwhr in Thousands)			
By Fuel Burning Plants	45,477,900	43,636,893	+ 4.2
By Water Power Plants	13,239,392	12,170,142	+ 8.8
Total Generation	**58,717,292**	**55,807,035**	**+ 5.2**
Add—Net Imports Over International Boundaries	381,919	309,992	+23.2
Less—Company Use	162,178	162,349	− 0.1
Less—Energy Used by Producer	1,571,344	1,393,142	+12.8
Net Energy for Distribution	**57,365,689**	**54,561,536**	**+ 5.1**
Lost and Unaccounted for	3,189,406	4,127,340	−22.7
Sales to Ultimate Customers	**54,176,283**	**50,434,196**	**+ 7.4**
CLASSIFICATION OF SALES			
NUMBER OF CUSTOMERS—As of April 30			
Residential or Domestic	49,261,864	48,066,625	+ 2.5
Rural (Distinct Rural Rates)	1,567,454	1,628,106	− 3.7
Commercial or Industrial:			
Small Light and Power	6,353,489	6,282,917**	+ 1.1
Large Light and Power	341,323	340,393**	+ 0.3
Other Customers	197,256	190,343	+ 3.6
Total Ultimate Customers	**57,721,386**	**56,508,384**	**+ 2.1**
KILOWATT-HOUR SALES—During Month of April (Kwhr in Thousands)			
Residential or Domestic	15,592,051	13,906,937	+12.1
Rural (Distinct Rural Rates)	1,076,015	1,082,834	− 0.6
Commercial or Industrial:			
Small Light and Power	8,695,928	7,982,328**	+ 8.9
Large Light and Power	26,584,161	25,495,448**	+ 4.3
Street and Highway Lighting	488,196	453,798	+ 7.6
Other Public Authorities	1,281,394	1,149,958	+11.4
Railroads and Railways	409,991	307,081	+33.5
Interdepartmental	48,547	55,812	−13.0
Total to Ultimate Customers	**54,176,283**	**50,434,196**	**+ 7.4**
Revenue from Ultimate Customers (Thousands)	**$908,847**	**$842,723**	**+ 7.8**
RESIDENTIAL OR DOMESTIC SERVICE			
AVERAGE CUSTOMER DATA—For 12 months ended April 30, 1960			
Kilowatt-hours per Customer	3,674	3,427	+ 7.2
Average Annual Bill	$91.48	$86.36	+ 5.9
Revenue per Kilowatt-hour	2.49¢	2.52¢	− 1.2

* By courtesy of the Federal Power Commission.
** Revised for comparison purposes.

Vol. 28 • No. 7

EEI BULLETIN Contents

July-August, 1960

Articles, Speeches, Reports

Current EEI Research Projects
H. P. Seelye 249

Dollar Savings in Fire Insurance Valuations
G. G. Blair 253

Remote Reading of Electric and Gas Meters
L. W. Garrand 257

Analysis of Fatal Accidents in the Electric Light and Power Industry in 1959
S. H. Young 261

48 Awards Presented for Safety Achievement 268

Meter and Service Committee Meeting
C. P. Stahl 271

Electrical System and Equipment Committee Meeting
R. G. Meyerand 272

Insurance Committee Meeting
R. R. MacKay, Jr. 274

Accident Prevention Committee Meeting
A. J. Naquin 275

Transmission and Distribution Committee Meeting
H. E. Cody 276

News, Notes, Miscellany

Conventions and Meetings 248

Training Course Available on Electric Heating 269

People in Power 278

The EDISON ELECTRIC INSTITUTE BULLETIN is published monthly, except bi-monthly in July and August, by the Edison Electric Institute, an association of electric light and power companies in the United States and its territorial possessions. Its affiliate members consist of private electric utilities in North, Central and South America and contiguous islands in the Western Hemisphere.

The objectives of the Edison Electric Institute are:

The advancement in the public service of the art of producing, transmitting, and distributing electricity and the promotion of scientific research in such field.

The ascertainment and making available to the members and the public of factual information, data, and statistics relating to the electric industry.

To aid its operating company members to generate and sell electric energy at the lowest possible price commensurate with safe and adequate service, giving due regard to the interests of consumer, investor, and employee.

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Conventions and Meetings

1960

September

1- 2 Southeastern Electric Exchange Personnel Administration Section Convention, Roanoke Hotel, Roanoke, Va.
7- 8 EEI Street and Highway Lighting Committee, Salem, Mass.
7- 9 NELPA 53rd Annual Meeting, Glacier Park Lodge, Glacier, Mont.
7-10 Rocky Mountain Electrical League Annual Fall Conference, Hilton Hotel, Denver, Colo.
11-16 IES 1960 National Technical Conference, Penn Sheraton Hotel, Pittsburgh, Pa.
12-13 EEI Residential Lighting Promotion Committee, Hopkins Airport Hotel, Cleveland, Ohio
14 PIP Steering Committee, Hotel Pierre, New York City, N. Y.
15-16 EEI-AGA Accounting Division and Section Organization Meetings, The Pittsburgh Hilton, Pittsburgh, Pa.
15-17 Public Utilities Association of the Virginias' 42nd Annual Meeting, Greenbrier Hotel, White Sulphur Springs, W. Va.
18-21 EEI Meter and Service Committee, Westchester Country Club, Rye, N. Y.
19-20 EEI Residential Electric Heating & Air Conditioning Committee, EEI Headquarters, New York, N. Y.
20-21 EEI Commercial Electric Space Heating & Air Conditioning Committee, Columbus, Ohio.
21-22 PEA Annual Meeting, Penn Sheraton Hotel, Pittsburgh, Pa.
21-23 IIFEUC Seventh Annual National Electric Farm Power Conference, Kentucky Hotel, Louisville, Ky.
21-23 ASME-AIEE Power Conference, Bellevue-Stratford Hotel, Philadelphia, Pa.
21-23 EEI Industrial Power and Heating Group, Milwaukee, Wis.
22-23 EEI Residential Wiring Promotion Committee, Salem, Mass.
22-23 Missouri Valley Electric Association Accounting Conference, President Hotel, Kansas City, Mo.
26-27 EEI Commercial Lighting Committee, Alabama Power Co., Birmingham, Ala.
26-27 EEI Farm Group, New York City, N. Y.
26-27 EEI Residential Appliance Promotion Committee, New York City, N. Y.
26-28 EEI Industrial Relations Committee 13th Annual Round Table Conference, Drake Hotel, Chicago, Ill.
28 ECAP Copy Group Meeting, New Orleans, La.
27-28 EEI Market Research Committee, Harlan House Motel, Detroit, Mich.
28-29 Southeastern Electric Exchange Accounting Conference, Tides Hotel, St. Petersburg, Fla.
28-30 Indiana Electric Association 51st Annual Convention, French Lick-Sheraton Hotel, French Lick, Ind.
29-30 EEI Home Service Committee, Fort Worth, Texas.
29-30 PIP Workshop Conference, Sheraton Charles Hotel, New Orleans, La.

October

3- 4 PEA Systems Planning Committee, Erie, Pa.
3- 5 Prime Movers Committee, Benjamin Franklin Hotel, Philadelphia, Pa.
5- 7 Missouri Valley Electric Association Sales & Rural Conference & Home Service Workshop (joint meeting with International Association of Electrical Leagues), President Hotel, Kansas City, Mo.
5- 7 Wisconsin Utilities Association Electric & Gas Sales and Operating Sections Convention, Schroeder Hotel, Milwaukee, Wis.
6 EEI Power Survey Committee, EEI Headquarters, New York City, N. Y.
6- 7 PEA Electrical Equipment Committee, Philadelphia, Pa.
6- 7 Transmission and Distribution Committee, Sheraton Jefferson Hotel, St. Louis, Mo.
9-14 AIEE Fall General Meeting, Chicago, Ill.
10-12 AIEE National Electronics Conference, Chicago, Ill.
13-14 PEA Meter Committee, Altoona, Pa.
17-18 Electrical Systems & Equipment Committee, Hotel Northampton, Northampton, Mass.
20-21 Electric Council of New England 4th Annual Conference, Hotel Somerset, Boston, Mass.
20-21 Southeastern Electric Exchange Engineering & Operation Section, The Shoreham Hotel, Washington, D. C.
20-22 PIP Second National Youth Conference on the Atom, Museum of Science & Industry, Chicago, Ill.
22-26 Controllers Institute of America 29th Annual National Conference, Hotel Fairmont, San Francisco, Calif.
24-26 EEI Insurance Committee, French Lick Sheraton, French Lick, Ind.
25-27 American Standards Association National Conference on Standards, Sheraton-McAlpin Hotel, New York, N. Y.
26-29 Rocky Mountain Electrical League Annual Meeting, Colorado Springs, Colo.
27 BLBS Executive Committee, New York, N. Y.
27-28 EEI Statistical Committee, The Homestead, Hot Springs, Va.
27-28 PEA Transmission & Distribution Committee Fall Meeting, Hotel Alexander, Hagerstown, Md.

November

2- 4 EEI-AGA Taxation Accounting Committees, The Cloisters, Sea Island, Ga.
9-10 New Jersey Utilities Association Annual Meeting, Seaview Country Club, Absecon, N. J.
14-15 PCEA Administrative Services Section, Phoenix, Ariz.
14-16 EEI Accident Prevention Committee, Statler-Hilton Hotel, Buffalo, N. Y.
14-18 NEMA Annual Meeting, Traymore Hotel, Atlantic City, N. J.
15-16 Area Development Workshop, Park Plaza Hotel, St. Louis, Mo.
16-18 Southeastern Electric Exchange General Sales Conference, Henry Grady Hotel, Atlanta, Ga.
17-19 Canadian Electrical Association Engineering Sections, Western Zone, Saskatchewan Hotel, Regina, Sask., Canada
18-22 Air-Conditioning and Refrigeration Institute Annual Meeting, Hollywood Beach Hotel, Hollywood Beach, Fla.
21-23 Canadian Electrical Association General & Sales Sections, Western Zone Palliser Hotel, Calgary, Alberta, Canada
27-Dec. 2 ASME Winter Annual Meeting, Statler-Hilton Hotel, New York City, N. Y.
28-30 Electronic Seminar, Atlantic City, N. J.
28-Dec. 1 NARUC Convention, Las Vegas, Nev.
30 ECAP Copy Group Meeting, New York City, N. Y.

December

1- 2 Pacific Coast Electrical Association Administrative Service Fall Conference, Hotel Safari, Scottsdale, Ariz.
8 EEI Industrial Relations Committee, Roosevelt Hotel, New York City, N. Y.
8- 9 EEI-AGA Depreciation Accounting Committee, Atlanta Biltmore, Atlanta, Ga.

Current EEI RESEARCH Projects

By H. P. Seelye
Consultant for EEI Research Projects Committee

FOR many years EEI has been sponsoring or supporting certain research projects of particular importance to the electric utility industry. In the past, no particular effort has been made to search out subjects which might warrant such attention, but, rather, support has been granted to those projects which have been recommended by some committee or division of the Institute as being of special immediate necessity.

Importance of Research Told

The research surveys by the Research Projects Committee in 1956 and 1958 have called attention to the importance of research to the industry and to the considerable amount of such work being done by individual member companies. They have also served to stimulate interest in coordinated research by EEI as a whole. More recently definite efforts have been made to direct the attention of the Engineering Committees and other EEI Committees to research subjects which are worthy of investigation. All this has resulted in an appreciable increase in the number of research projects proposed by these committees to the Research Projects Committee and, consequently, in the number of projects approved and undertaken.

In some cases these projects are initiated and directed by the committee or division making the recommendation, thereby constituting EEI sponsorship. Outside organizations, such as manufacturers or technical societies, sometimes collaborate in the work and in the expense. In other cases, the project may be sponsored by an outside organization such as the American Institute of Electrical Engineers, American Society for Testing Material, American Society of Mechanical Engineers, etc., with EEI participating by financial contributions. Liaison with each of these projects is maintained through the committee or division which recommended or endorsed it. Collaboration between EEI and AEIC on both types of projects is quite common, the interests and memberships of these organizations being similar.

Information on the EEI-supported research projects has been given from time to time in the EEI BULLETIN, particularly when new ones were undertaken or when a project was finished. It is the present purpose to set forth a more comprehensive picture of what is being done by brief descriptions of all of such projects now under way or recently completed.

Projects Sponsored by EEI, Including Joint Sponsorship

1. Removal of Sulphur from Steam Coals—Methods of Control of Atmospheric Contaminants

The control of atmospheric contamination by exhaust gases from power plant stacks is a problem of continually increasing importance to the electric power industry as plant sizes get larger and as population densities and contamination from other sources increase. This project, started in 1958, is directed toward the development of fundamental information and possible new approaches to the removal of sulphur from coal before it is burned and to the removal of sulphur dioxide and sulphur trioxide from flue gases. A considerable amount of favorable progress has been made in this study although no conclusive results are as yet available.

The project is being sponsored jointly by EEI, AEIC, and Bituminous Coal Research, Inc. EEI participation is through the Prime Movers Committee.

2. Direct Conversion of Energy to Electricity

The possibilities of practical direct conversion of heat energy into electricity in large quantities is of great interest to electric utilities, not only for the economy of generation which might be realized, but also for the possible elimination of the present limitation on plant locations to sites at which large volumes of condensing water are available. This would allow greater dispersion of generating capability throughout a system, avoiding some of the problems of air pollution and of transmission voltages and rights of way attendant on very large steam plants.

Several methods of direct conversion have been known but, for the most part, these have not been applicable to major power generation. Recently, certain developments in the fields of thermoelectricity, thermionics, magnetohydrodynamics and fuel cells have offered promise of eventual practical solution of this problem. This research project, which is just now getting under way, constitutes a survey of present knowledge and developments in all of the various methods of direct generation, leading to recommendations on how future action by the industry might best be directed.

The project is sponsored by EEI, under the direc-

tion of the Prime Movers Committee and the Electrical System and Equipment Committee, jointly.

3. Extra-High-Voltage Cable

Transmission at 345 kv is established in this country, and still higher voltages are being projected. It is inevitable that underground cables will eventually be required to supplement overhead lines at these voltages. This research project is directed specifically toward the development of cables for 345 kv with a loading capability of 500 mva or more. It was started in 1957 and is scheduled to continue through 1963. Considerable progress has been made in the preparation of such cables and in setting up test facilities at Cornell University.

The project is sponsored jointly by EEI and AEIC with substantial participation by cable manufacturers and support by individual utilities. EEI direction is through the Transmission and Distribution Committee.

4. Tree Control

One of the major costs to electric utilities in their overhead line operation is in the trimming of trees which might interfere with the wires, causing service interruptions. The development of some practical method for retarding tree growth would result in appreciable savings, estimated at as much as $25 million per year. The object of this research project is to investigate all methods which have been or may be proposed for such a purpose, particularly those of chemical control, and the determination of effective and satisfactory measures for tree control. The project was started in 1958 and is scheduled to continue to 1963. Encouraging progress is reported but no conclusive results as yet.

It is sponsored by EEI, under the direction of the Transmission and Distribution Committee, with representatives of tree care organizations serving as advisers.

5. Electrical Resuscitation

The unknown cause of the death of a considerable number of victims of electric shock who had received prompt artificial respiration instigated, in 1951, an investigation into ventricular fibrillation. This is an uncontrolled "fluttering" of the heart which can result from the passage of electric current through it. The study also included consideration of means for arresting fibrillation by counter shock. The work has been carried on by Dr. W. B. Kouwenhoven at Johns Hopkins University, with EEI support. Tangible results to date have been the development of non-portable defibrillation equipment for hospital use. Further work is proceeding on the application of the method to field use.

The EEI sponsorship has been under the direction of the Accident Prevention Committee.

6. Interchangeability of Aluminum Compression Tools and Fittings

It is highly desirable that the fittings (sleeves) made by different manufacturers for splicing aluminum line conductors, and the tools used in applying them, have some degree of interchangeability. Otherwise, any utility is limited to the fittings and tools of the one manufacturer whom he may select. A great amount of work on such standardization was done during the four years, 1955 to 1959, by the Transmission and Distribution Committee, in cooperation with the manufacturers. In order to carry out the additional testing needed for a conclusive result, this project has recently been given general EEI sponsorship, under the direction of the Transmission and Distribution Committee.

7. Lateral Stability of Poles

The present increasing trend toward curving streets in new residential developments has emphasized the need for more information and for improved methods in sustaining unguyed poles subjected to unbalanced loads. The EEI and the Bell Telephone System in 1957 joined in the sponsorship of this research project to determine stresses and movements in the ground of such poles and the effect of cribbing at different depths below the ground surface. The work is very nearly completed.

The project is directed by the EEI/Bell System Joint Subcommittee on Development and Research.

8. Loss of Preservative in Poles

In 1947, the U. S. Forest Products Laboratory installed a large number of stakes treated with pentachlorophenol preservative with various different types of carrier liquids used as the solvent. In order to obtain information on the retention of this preservative in these southern pine specimens as a guide to its behavior in treated pine poles, they were analyzed in the above-ground and below-ground sections. The work has been completed but the final report is not yet available.

The project was sponsored by EEI, under the direction of the Transmission and Distribution Committee.

9. Iron Oxide Deposits

Deposits of magnetic iron oxide in boilers, steam valves, feedwater heaters and pumps of high-pressure power stations constitute a serious problem to power plant operators. While a two-year EEI research program which was initiated in 1954 contributed to the information on this subject, it did not result in a solution to the problem. A subsequent survey of EEI member companies to determine their experience and activities in this connection, conducted by the Power Station Chemistry Subcommittee of the Prime Movers Committee, has yielded a considerable amount of data which has yet to be analyzed and digested.

EEI has undertaken a project for this purpose, sponsored by the Prime Movers Committee.

10. Water Pollution

This project comprises the retention of a consultant to conduct a survey and prepare a report on the various water pollution factors which affect electric

EEI Research Projects

generating stations, with particular attention to the so-called "thermal pollution" of streams, which results from condenser water discharge.

It is sponsored by EEI, under the direction of the Prime Movers Committee.

11. Galloping Transmission Lines

The "galloping" of line conductors on transmission and distribution lines under certain ice and wind loading conditions continues to be a serious problem with a large number of electric utilities. Although much study has been given it, the basic causes are not well understood and effective remedies are not available. This project includes a study of available information, and laboratory research in the Aeroelastic and Structures Research Laboratory of the Massachusetts Institute of Technology, to provide fundamental data, analyses, and recommended mitigating measures. Work was recently started (1959) and will continue through 1961.

The project is sponsored by EEI, and directed by the Transmission and Distribution Committee. Manufacturers and individual utilities are participating in its support.

12. Survey of Single-Phasing Failures of Three-Phase Motors

For a number of years some question has existed as to the necessity of a National Electrical Code provision requiring three instead of two over-current protective devices for three-phase motors. Electric utility company representatives report that with the increasing trend toward three-phase air conditioning and heat pump installations, along with general refrigeration in commercial and residential areas, there is a growing number of failures of three-phase motors caused by single phasing resulting from wires-down, blown transformer fuses, etc., and point out these motor failures could be prevented by requiring the third protective device in the customer's equipment.

To obtain information concerning the experience of utilities, users, manufacturers and electrical inspectors, the EEI and NEMA are jointly sponsoring a factual survey by Underwriters' Laboratories. The data obtained will provide the basis for study and recommendation by a task committee of the National Electrical Code Making Panel No. 11.

Participation in this program was recommended by the Transmission and Distribution Committee.

13. Heat Pump Water Heater

The development of a low-cost, heat pump water heater with high performance factor offers attractive possibilities of increasing the industry's sales of electric water heating. There seems to be a good likelihood that such a practical development can be made. This project is for the purpose of investigating all available equipment, heat sources, water heater requirements, manufacturers' interest, potential markets, etc., leading to a recommendation for future specific research in design and testing of equipment.

It is sponsored by EEI and AEIC, under the direction of the Joint AEIC-EEI Heat Pump Committee.

14. Research Survey

The Research Projects Committee in 1956 initiated a survey of the EEI membership to determine the amount, nature and scope of research work under way or recently completed by member companies. A supplementary survey was made in 1958 and another is in progress at this time. Results were distributed to EEI members in a "Consolidated List of Research Projects" and information on individual projects made available to them on request. This work has developed in the direction of increased activity in research by EEI as a whole.

Completed Projects (Recent)

15. Heat Storage

The development of a practical method of storing heat for use in conjunction with heat pumps and other electrical heating and air-conditioning installations is needed in order to improve their relatively low load factor. No heat storage method is now available which satisfies the requirements of low first cost, high storage capacity, compactness, controllability, and reliability. The preliminary stage in the study of this problem has been covered by this research project during 1958-1959, which comprised a review of existing literature on the subject, analysis of the requirements and the possibilities, and recommendations for further research. The work was completed in 1959, with results being reported in the June, 1959, EEI BULLETIN. Additional studies, based on the recommendations on the report, are under consideration, but no specific projects have, as yet, been initiated.

The project was under EEI and AEIC joint sponsorship, directed by the Joint AEIC-EEI Heat Pump Committee.

16. Aluminum Conductor Fittings

The objective of this project was to learn what factors contribute to the failure of aluminum conductor fittings (connectors), and to measure the relative importance of each. This would provide information for the writing of connector specifications. The project was completed in 1957 and a summary report was published in the March, 1958, EEI BULLETIN. A resulting "Tentative Specifications for Connectors for Aluminum Conductors," EEI Publication No. 59-70, has been issued by EEI.

The project was sponsored by EEI, and directed by the Transmission and Distribution Committee, with cooperation by the connector manufacturers.

17. Electronic Accounting Machines

The trend toward the use of machines for accounting processes led to a project, in 1955, to look for possible simplification and improvement in the equipment then available. This developed into a detailed study of the component operations in utilities' cus-

tomer accounting, and the projection of a machine specially and exclusively adapted for the purpose. The work was completed and the results of a report prepared by the Computation Laboratory of Harvard University were published in the September, 1959, EEI BULLETIN. This was also the subject of Research Monograph No. 3 of the Research Projects Committee.

The project was jointly sponsored by EEI and the American Gas Association, and directed by the Accounting Division and the Accounting Section, respectively, of these organizations.

Projects Sponsored by Others but Supported In Part by EEI

18. High-Temperature Steam Generation

In view of the trend toward higher steam pressures and temperatures in power plants, it is important that information be obtained on the suitability and service performance of various alloys available for superheater tubes. This project has had as its objective the study of the characteristics of the oxide film (method of formation, thickness, permanence of thermal conductivity) formed on steam-swept surfaces at temperatures up to 1500 F, the resistance of alloys to furnace gases, the metallurgical stability of the materials under long-time exposure to high temperatures, and the effect of rapid tube quenching during soot blowing. The work was started in 1959 and is still continuing. A considerable amount of valuable information has been obtained and numerous progress reports and papers on it have been published.

The project is sponsored by the American Society of Mechanical Engineers, with cooperation from manufacturers, individual utilities, and the U. S. Navy Department. EEI is contributing financially, with liaison through the Prime Movers Committee.

19. Extension of Steam Tables

The temperatures and pressures of steam generation used by electric utilities and other industries have exceeded considerably the limits of the experimental investigations of thermodynamic properties (860 F and 5300 psia) which were the basis of the international skeleton steam tables of 1934 and of the present American steam tables. It is imperative that a revision and extension of this field of knowledge be made. This project comprises laboratory investigation of thermodynamic properties and of "transport properties" (thermal conductivity and viscosity), also of the relaxation rate of the water molecule at high pressures and temperatures. It includes cooperative activities with others in this country and in foreign countries to promote the establishment of an Extended International Skeleton Table and ASME steam tables extending to 1500 F and 15,000 psia.

The project was started in 1955 and is still continuing. Considerable progress has been made, but it will be some time before the project is completed.

It is sponsored by the American Society of Mechanical Engineers, with financial support by EEI and by equipment manufacturers. Liaison is through the Prime Movers Committee.

20. Fluid Meters

Many accurate measurements of the flow of steam and of hot water must be made in the operation of modern high-pressure, high-temperature steam generating plants. At present, measurements are subject to some doubt because the meter constants used are extrapolated from water flow calibrations at lower temperatures and pressures. The objectives of this project are to determine any unanticipated changes which may occur in the shape, size, or finish of the primary metering elements, and if compensating factors for these changes should be incorporated into the flow equation; also to determine the relative accuracy of using data extrapolated from cold water tests.

Financial support for the project has not yet been completely arranged so little work has been done.

The project is sponsored by the American Society of Mechanical Engineers. EEI will contribute, with liaison through the Prime Movers Committee.

21. Stainless Steel Pipe Welding Failures—Stainless Steels for High-Temperature Superheater and Reheater Service

These two related projects were initiated because of experience with cracking adjacent to welds in stainless steel, high-temperature, high-pressure, main steam piping, and because of the failure of stainless steel superheater and reheater tubes resulting from swelling and creep rupture. Present knowledge is considered insufficient to allow these problems to be adequately solved and the objective of the projects is to obtain such data. They are part of the general program of the ASTM-ASME Joint Committee on the Effect of Temperature on the Properties of Metals, which has had support in the past from EEI. These projects were started in 1959 and are still continuing. EEI is supporting them financially, with liaison through the Prime Movers Committee.

22. Solvent for Pentachlorophenol

Pentachlorophenol has a large use by utilities as a preservative for wood poles. With a hope of discovering a better type of solvent than the petroleum derivitives presently used in the treating process, this project is to investigate the characteristics of an "ideal solvent" which would reduce migration and loss of the toxicant, achieve a minimum of bleeding, and reduce sludging and emulsification in the treating plant. The project, started in 1958, is being conducted by the University of Florida.

It is sponsored by the American Wood Preservers Association with financial support by EEI and other pole users, and by chemical manufacturers and pole treating companies. Liaison is through the Transmission and Distribution Committee.

(*Continued on page* 270)

Dollar Savings in FIRE INSURANCE Valuations

By G. G. Blair
Engineer, Insurance, Safety & Pensions Department, Ebasco Services Inc.

DISCUSSIONS of insurable values have frequently been on the agenda of Ebasco's client company insurance conferences for the benefit of the persons charged with the handling of their company's insurance program. This indication of the importance of the subject persists despite the fact that property insurance valuations are often the responsibility of other departments in the companies represented.

Insurance valuations are distinct from valuations for various other purposes. Therefore, it is most appropriate that a presentation be made to an accounting group of the possibilities for savings in fire insurance valuations, to illustrate basic data that have been of broad interest at similar conferences of insurance personnel.

Since it is imprudent to buy insurance in excess of the amount of probable indemnification, a proper evaluation of the subject of insurance is necessary. It is essential to know just what the insurable values are, and what categories, or portions, of them may be excluded from required insurance.

The usual fire insurance contracts provide for an actual cash value reimbursement, and various forms that must be appended to the contract require insurance to the extent of this valuation or a specified high percentage of it.

Certain established rules governing the business pertain to stated allowable exclusions of parts of individual properties from the values of the premises insured. Such exclusions relate chiefly to the requirements under various coinsurance clauses indicated on and appended to the contract.

In addition, the buildings, equipment, and contents to be insured may be explicitly stated, or be broadly defined with explicit exclusions.

Thus we have to make a determination of actual cash value, as a basis for the amount of insurance required in most cases, and also for the determination of the amount of settlement in event of a loss. In this determination of insurable values we must exercise a choice of the property to be covered; ascertain certain allowable exclusions of portions of the property covered; and make a sensible deletion of certain items from the original costs.

Actual Cash Value

The insurable value is referred to as the "actual cash value" on the face of the policy and also in the requirements for settling of losses. It is not further defined.

General usage has produced a simple definition of actual cash value as being the replacement cost new, less depreciation. There have been exceptions to this method of ascertaining value following a loss, and there is at least one important precedent established: providing that any and all means of arriving at a fair value should be employed.

One good illustration would be the price agreed upon between a willing buyer and a willing seller. In most cases the replacement cost new quite readily can be agreed upon, but this approach brings up the question of depreciation, which is quite a subject in its own right and beyond the scope of present consideration. Various rates of depreciation may prove acceptable, or the functional potential or capability of the property may be obvious.

From the replacement or reproduction costs there are certain exclusions used in fire insurance forms and also some rather important indirect cost items of a controversial nature.

Insurance Exclusions

The exclusions pertain tc portions of individual properties, and to a choice of types of property. These exclusions are:

1. Portions of Individual Properties.

An address before the Pennsylvania Electric Association 1960 Annual Accounting Conference, Philadelphia, May 16, 1960.

For specific properties certain exclusions are allowable under established rules to eliminate such values from consideration under the terms of the coinsurance clause, and also to establish a limit to the amount of indestructible portions of the property that may be erased from the coverage. The coinsurance clause grants credits for carrying the required amount of insurance, so naturally there are rules limiting the exclusions to specific property values. It also provides for a proportionate payment of loss if the insurance amount is insufficient.

Generally, foundations, underground property and property in the open are established as the portions of the property that need not be included in the coverage.

With reference to foundations, it is the usual practice to exclude excavations and the foundations of buildings and machinery which are below the undersurface of the lowest basement floor or which are below the surface of the ground inside the foundation of the building. However, in some cases, such as under builders' risk policies, exception may be taken to this exclusion, and in other cases, such as under earthquake policies, it is not considered desirable to exclude foundations. In some instances where massive foundations of reinforced concrete are involved, such as at some hydroelectric stations, where the possibility of damage to the foundations is almost nonexistent, and where a "below-ground" or "below-low-water" exclusion is unreasonable or a controversial limitation, it is often possible to amend the usual foundation exclusion clause to exclude coverage on portions below a stated elevation.

Other underground property customarily excluded under the rules consists of underground flues, pipe, wiring and drains.

Various real and personal property in the open is construed as a permissible exclusion, such as railroad tracks, masonry stacks detached from buildings, motor vehicles, materials stored outside, such as minerals and metals, property stored in open yards when it is not the intent to insure it, piling for buildings or wharves not extending above low-water mark, and water wheels.

2. Types of Properties.

From the standpoint of the choice of types of property covered, what is excluded depends to a large extent upon the desires of the insured. For example, under the blanket fire insurance contracts commonly used by utility companies, with certain limitations, many types of property on which coverage is not desired for various reasons may be excluded. These include property which is insured under other types of insurance contracts, and certain classes of property presenting low loss potentials due to their not being highly susceptible to damage by the perils covered, or being dispersed so that loss liability is limited.

Property otherwise insured includes several types of property which can be covered to better advantage under other types of insurance contracts, from the standpoint of cost or perils covered. This would include motor vehicles, generally insured to better advantage under automobile policies, and buildings under construction, often covered to better advantage under builders' risk policies, and certain types of properties susceptible to damage from perils other than fire and the allied hazards that are often covered under all risk policies.

Underwater property can generally be safely excluded. However, in water-powered operations, water wheels and turbines might be considered as being an exception to this rule, especially when installed above the level of the lowest floor where they would be susceptible to damage from falling debris resulting from a fire or other peril insured against.

Dams and penstocks can usually be excluded from coverage, particularly if of non-combustible construction, but it may be advisable to so word the exclusion that it will not apply to structures and equipment on the dams. It is also quite common to exclude coverage on bridges, tunnels, spillways, fish ladders, penstocks and flumes which are outside of buildings, and dikes and retaining walls outside and not parts of buildings, particularly when of entirely non-combustible construction.

Where combustible materials are involved in any of these general types of properties the decision to exclude them from coverage should be based on a careful analysis of the loss potential considering the amount of combustible material involved and possible exposure from fire in a nearby building or forest.

Operating equipment of low value, or widely dispersed, constitutes a very substantial investment in different types of operating properties and presents a "spread of risk" warranting serious consideration for self-insuring by excluding it from the coverage. Such properties include transmissions and distribution lines, metering equipment, and outdoor substations of the smaller capacities. In determining the extent of such exclusions, consideration should be given to the maximum aggregate loss that the company can prudently absorb, the maximum loss likely at any one location, the loss frequency in such property, and the insurance cost savings which would result by self-insuring such property.

The exclusion of transmission and distribution lines which are in excess of 100 feet from insured buildings or equipment is quite common, since the possibility of a severe loss involving such lines is rather remote. Some companies exclude all metering equipment, while others exclude only meters on the premises of residential customers. In the case of outdoor transformer installations, it is quite common to exclude those where a given total installed capacity is stated, such as 100 or 300 kva.

3. Direct Charges.

It is obvious that all direct charges for items of property excluded should be eliminated when compiling insurable values, but it should also be remembered that there may be substantial indirect charges in connection with such excluded items of property which should also be eliminated from the values. For example, if it is determined that 10 percent of a total

building value applies to foundations excluded from the coverage, 10 percent of the overhead charges against the building should also be deducted as pertaining to this item. Likewise, in the case of a large hydroelectric project, care should be taken that proper deductions are made for overhead charges that should properly be allocated to items of property which are excluded, such as dams.

In addition to these direct charges there are also several indirect charges and controversial costs to be given consideration as exclusions from the insurable values.

Controversial Costs and Indirect Charges

Partly or entirely, a justifiable elimination from original costs in determining insurable values as distinct from valuations for other purposes, are: site preparation, construction equipment and sheds, roads, railroads and bridges, premium labor charges, interest and taxes during construction, design engineering, and plans and specifications.

Costs that should probably remain as insured would include freight and installation charges, insurance premiums during construction, certain technical services, construction supervision fees.

1. Most costs in connection with the preparation of sites should be eliminated. Such would include cost of surveys, explorations, borings, etc. In addition, the cost of temporary equipment which is disposed of after the project is completed should ordinarily be excluded, while permanent equipment which remains on the property should be considered as insurable.

2. Construction equipment for use at large projects is often purchased and installed only for use during the construction of the plant and then removed or possibly sold at a sacrifice. Generally, this equipment is not "used up" and would be suitable for use much longer than the period for which it was required for the particular project. Therefore, whereas the net cost of the equipment so far as the project in question is concerned would be represented by the difference between the cost of installation plus the cost of removal less any amounts received from its sale when the job is completed, it does not necessarily follow that all of this net cost, as distributed among the individual items of property included in the project, can be considered as insurable.

As to the proportion of this net cost which should be considered as insurable, no definite rule can be established. In general, it would seem logical that when construction equipment is removed after construction work is completed, the net cost of this equipment which is distributed should not be included as part of the insurable values of the various items of the property unless the use of this equipment resulted in the total costs of those properties being less than would have otherwise been the case, and then only to that extent.

As an example of this procedure, in the case of a large hydroelectric project, a large concrete mixing plant costing in excess of a half million dollars was constructed. After the project had been completed, this plant was entirely dismantled with only a rather negligible recovery made for certain parts, which were sold at sacrifice prices. Therefore, the net cost of this concrete mixing plant, consisting of its original cost plus the cost of its removal, less the amounts recovered by the sale of parts, was capitalized and distributed among the various items of property included in the project. In this case, it did not seem that the net cost of this plant, allocated to the various items of property, should be considered as insurable. Accordingly, these figures were substantially reduced so that they would approximate the reduction in the cost of concrete due to the concrete mixing plant, as compared with the cost if the concrete had been obtained from other sources.

The large concrete plant obviously essential to the construction of the combined dam and power house because of project size, mass pouring requirements, and timing for river flow conditions, could not be justified for the power house alone, much less to produce concrete for a repair job necessitated by a subsequent fire loss at the power house. Consequently, a realistic price per yard may be assumed for the concrete for the insured power house. Then the original concrete mixing plant values can be omitted entirely from the insurable values.

Needless to say, when construction equipment is retained after a construction program is completed, and insurance coverage on it is desired, proper insurable values for the equipment should be established specifically for such equipment.

3. Construction sheds constitute substantially the same problem as construction equipment. If the sheds and their removal are capitalized and distributed among the various items of property involved, these capitalized figures should be included in the insurable values only to the extent that the costs of the individual items of property were reduced by reason of the use of these sheds. If the sheds are retained after construction is completed, proper insurable values should be assigned to each and listed in the insurable values covered under the insurance contract in question.

4. Roads, bridges and railroads must often be built to reach the site of large construction projects, or existing highways or railroads may require relocation, particularly in the case of hydroelectric projects involving the flooding of reservoir areas. For accounting purposes, the costs of such roads, railroads and other facilities are often capitalized and distributed among the various items of property involved in the entire construction project. In ascertaining insurable values, however, all such capitalized costs should not be considered, but should be included only to the extent that they would be repeated in the event of the total destruction of the item of property involved. In many cases if a plant were totally destroyed, necessitating rebuilding, practically no new roads would have to be built. Therefore, practically none of the original cost of such roads should be included as part of the insurable value of the plant. On the other hand, if certain access roads necessary for construction are entirely eliminated after the job is completed, but would be required again in event of destruction of the plant, at least part of the cost of such should be considered as insurable.

5. Premiums paid for overtime work and quick delivery of equipment must be considered as having been for the purpose of expediting the completion of the work. They are not part of the insurable value under property damage insurance contracts. (Such costs, within limitations, are collectible under business interruption insurance contracts; even in the latter case they are not a part of the determination of the insurance amount.)

6. Interest charges and taxes during construction are not an insurable value under property damage contracts although they may be considered so under business interruption insurance.

7. Charges for design, engineering, overhead and the like are generally considered as being insurable items. However, where these charges are abnormal for one reason or another, the amounts included in the insurable value should be reduced, perhaps drastically. The amounts of such reductions can be determined only after careful analysis, and a definite rule cannot be established. For example, such charges may be exceedingly high for the first unit of a plant of entirely new design and be greatly reduced for future units of the same type. In determining the portion of the charges to be included in the case of the first unit, careful consideration should be given to the probable charges for the future units. In all probability the actual charges to be included as insurable values should more nearly equal those that would be in order for the units installed at later dates.

8. Plans and specifications cost inclusion as part of the insurable value is controversial. Strictly speaking, under standard fire insurance contracts, unless such costs are definitely excluded, they should probably be considered as part of the insurable value. On the other hand, if complete plans and specifications are retained and kept in a safe location away from the building or equipment to which they apply, recovery for the cost of these papers would probably never be required under the insurance contracts applying to the property involved. In the latter case, therefore, it is entirely possible that in the event of a loss, the full loss may be recoverable even though the cost of plans and specifications is not included in the insurable values, despite the fact that technically the amount of insurance in effect might be said to lack compliance with the coinsurance features of the contract.

To illustrate the controversial aspects of the planning costs discussed in "7" and "8" above, the foregoing statements constitute a pretty fair consensus. However, in any consideration of such charges as insurable costs, it must be remembered that the cash value reimbursement guaranteed by the insurer is limited by the contract to what it would cost to repair or replace the damaged property—on the other side of the coin, then:

9. Plans, specifications, and design calculations, preliminary to the erection, result in a beautiful building or a well functioning plant, and are, in a sense, a part of the final project. That part resulting from existing science and its application, plus perhaps research and testing, while necessary to the original structure and operation, is in the minds of men and exemplified in the final product; the preliminary phases of the creation of the structure were first put to paper, and notes, calculations and drawings, specifications and requisitions, and after completion of the project, remain on paper although translated to steel and stone.

These valuable papers may be insured if necessary, it is true, and for very considerable amounts in projects of complicated design, but that is not pertinent to this discussion; pertinent here is the fact that the result in property or equipment must be insured; the design costs need not be. Exception is taken of course to the technical supervision and implementation of the plans during the erection process.

Errors, and the cost of removing and replacing faulty work, may unnecessarily have increased labor and material costs, and these should certainly not reoccur on a rebuilding job. What does not have to be repeated does not enter into the replacement cost.

Designs that are available are not a part of replacement costs, hence their omission from valuations is legitimate in determining required insurance amounts.

These costs may run 25 percent to 30 percent in complicated designs, and if this portion of cost is omitted from insurable values the only possibility for trouble would be a deficiency under the coinsurance clause, or an inadequate recovery under a total loss situation with specific insurance. With these factors nil, it is not necessary to buy insurance for this portion of the values. In addition, in event of a partial loss, it would be quite hard to get by with a 25 percent or 30 percent design charge that may have been apportioned to items of the plant.

10. Architects' and engineers' fees for supervision during construction should be considered as insurable items, since such costs would undoubtedly be necessary in event of a substantial loss when the supervision of repair and replacement work would be similar to the supervision required during the original construction. However, for ordinary properties, such costs are often excluded.

11. Other ordinary charges for supervision should be retained in the insurable values.

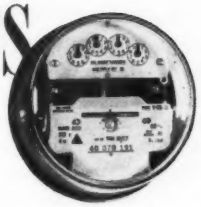
12. Freight and installation charges should also be considered as insurable items except for any premiums paid to obtain quick delivery.

13. Insurance premiums during construction are a necessary consideration in arriving at the insurable values. In any case, all types of insurance which a contractor would usually carry, including workmen's compensation, public liability and property damage, and builders' risk insurance, should be considered as insurable. On the other hand, business interruption insurance carried during the course of construction would not be considered as an insurable item under property damage insurance contracts.

14. Technical service charges should be considered as insurable to the extent that they are made in connection with the insurable property. Such charges as

(*Continued on page* 278)

Remote Reading of Electric and Gas Meters



By L. W. Garrand

Quality Manager, Fairchild Astrionics Division, Fairchild Engine and Airplane Corp.

A PROBLEM as basic and rewarding as the remote reading of power and gas meters cannot go unsolved for long. We all know this. Yet the same statement might have been made 10 or 20 years ago and proven incorrect.

I have what I believe to be a copy of all of the patents issued on the subject. There are approximately 40 in number, dating as far back as 1931, with the most recent being issued in 1959. To my knowledge, no successful hardware has resulted, and certainly no system is economically in use. We at Fairchild deal in angular position in seconds of arc; in time in fractions of a microsecond; and in distances anywhere from one one-hundred-thousandth of an inch to "way out there."

It seems incredible, therefore, at first glance that the relatively simple task of remotely reading the position of four dials has not already been accomplished. Perhaps the saying that "fools rush in where angels fear to tread" applies here.

I want to summarize the problem as we see it, pinpointing the specific problem areas, and discuss possible methods of solution and the accompanying economic problems. It would appear first that we should examine the problem on three bases—urgency, technical feasibility, and economic feasibility.

On the subject of urgency, it is obvious that, if it had become mandatory in the past either by legislation or lack of meter readers, you would today be reading meters remotely. I liken this to the problem that existed some years ago in railroading when it was obvious that the diesel was superior to the steam engine. Because of the capital investment required, and the fact that steam engines were good enough to do the job, no immediate move was made toward diesels. However, it is to be noted that the steam engine today is a rarity, the result of forward planning on a replacement basis. Another factor which is becoming more and more apparent is the fact that we are moving toward automation in data processing and billing. The only manual link remaining, in fact, is the manual reading of the meter. It would appear, therefore, that the urgency factor, which has not been as prevalent in the past, is increasingly demanding automation in meter reading.

As for the technical feasibility, almost without exception each of the above-mentioned patents might do the job. Indeed, one of them places a television transmitter at each meter site. There is no question that by this means the meter may be read remotely. It is obvious, however, that this method is economically unfeasible. Unfortunately a careful survey of the patents indicates this to be a fact in the majority of cases, while in others the problem has not been sufficiently thought through to result in a good technical solution.

The economics are certainly not to be ignored in this industry. Based upon an average annual cost of $2 for reading each meter—and some of you will say this is high—it has been stated that the overall installation capital investment which could be tolerated is $5 per meter. Here, then, is the reason why most efforts in this direction have come to a grinding halt. Let us look into the whole problem.

Figure 1 depicts the problem as containing three parts. First is the meter location; second the medium of transmission of data; and third the data processing or billing system. In its crudest form, the meter is read visually by a meter reader and the data is

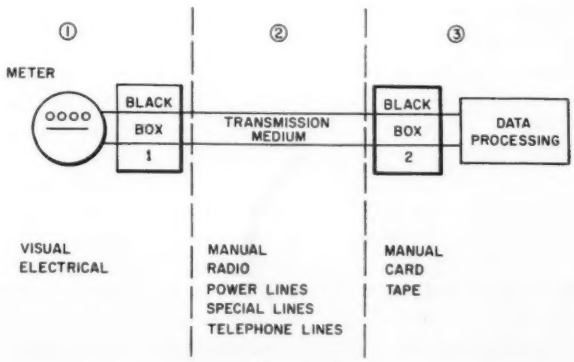


Figure 1

Presented before the EEI-AEIC Meter and Service Committees Meeting, Madison, Wis., May 24, 1960.

hand-carried back to the office where the bill is manually created.

In the data processing, many companies already are using cards or tape in sophisticated automatic billing systems. In some cases the cards have been prepared by the meter reader at the meter site by mark sensing or punching of the cards.

Those who are not using automatic processing certainly know that you will be doing so in the relatively near future. Therefore, we should like to eliminate the data processing and billing from our immediate problem area, saying only that our system must create a card or tape which is capable of being fitted into already existing systems for data processing.

At the meter site we note that the only other choice to visual reading is electrical reading. The medium of transmission, if we are to go automatic, can be a radio link, the power lines themselves, special lines installed specifically for the purpose, or existing telephone lines. The relative advantages and disadvantages appear to eliminate all but the special lines or the existing telephone lines.

Briefly, a radio link involves transmitter and receiver functions at each meter installation, or, at least, a transmitter. This would appear to be prohibitively expensive. Usage of the power lines themselves cannot be eliminated as a distinct possibility by using a form of carrier current transmission.

The line anomalies and impedances would appear to require extensive capital investments to accomplish the intended purpose.

In a nutshell, your power lines, however good they are for the purpose of power transmission, were certainly never designed for communication of intelligence. Such items as transformers, circuit breakers, lightning arresters, grid networks, grounding discontinuities, and others, motivate against communication and each must be solved by the installation of equipment.

The installation of special telephone-type lines for meter reading by the power company would certainly put the problem more directly under the control of the power company. However, it must be remembered that the lines are only a part of the system. The central office equipment required for identifying each customer's location is expensive, as the telephone companies know only too well. However, we must keep in mind the fact that this equipment installed for meter reading purposes alone could be drastically simplified due to the low traffic handling requirements.

Essentially, the installation of such lines would have to be examined from an economic rather than a technical viewpoint. The last choice, that of using existing telephone lines, has much in its favor since it is presently possible from a central source to dial every meter customer who also has a telephone. The disadvantage is readily apparent—installing telephone lines in each location which does not have a telephone line. This is estimated to be 10 percent of the total customers on a nation-wide basis based upon figures obtained from the telephone company. Our problem then would be the installation of a telephone line for 10 percent of the customers for the sole purpose of reading meters. Assuming this to be approximately $5 per installation, this cost would prorate at 50 cents per meter location. Economically this seems feasible. The advantage of using the existing dial system appears to more than offset this additional line cost. In the long run, the decision to use telephone company lines, or lines specially installed by the power company, will depend upon the relative cost of line leasing versus line installation.

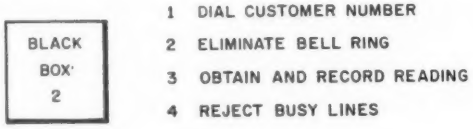


Figure 2

It can be noted on Figure 1 that, in order to convert the manual system to an automatic remote reading system, two new pieces of equipment, or modifications of existing equipment, will be required. They have been labeled Black Box I, or "readout system" at the meter location, and Black Box II, or "data processing system," located at the central office.

Here's what each of our black boxes must do.

Black Box II must be capable of dialing the customer's telephone number from information stored on a card or tape (Fig. 2). Upon obtaining that number it must by-pass the bell ringing system, leaving the customer's telephone undisturbed. It must then interrogate the meter and obtain the meter reading, registering it on the card or tape. In the event of a busy signal, it must reject the card or tape for later re-reading. This black box need not be elaborate and yet, for fool-proof usage, it may be required to contain computers requiring "go and no-go" limits, thereby recognizing a true reading from a false reading. In any event, Black Box II can be economically designed using existing techniques. It is to be remembered that Black Box II, being located at the central office equipment site, will exist in very small numbers, thus allowing a substantial cost when

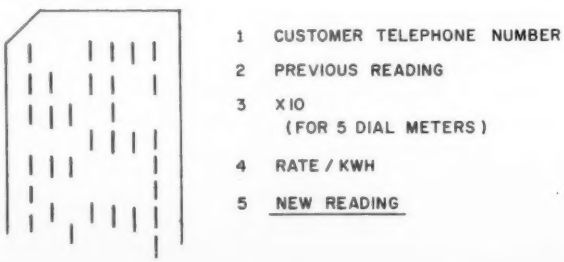


Figure 3

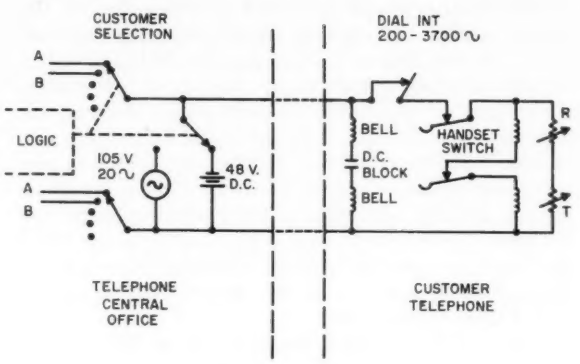


Figure 4

prorated over the whole meter reading system. The economic problem is not here but in Black Box I.

Figure 3 illustrates the data which must be contained on the card or tape for use with Black Box II. It consists of the customer's telephone number, his previous meter reading, an X 10 factor for five-digit meters, and a rate per kilowatt-hour. It must additionally have registered on it the new meter reading. The card can be immediately processed or stored for processing at a more convenient time, since it is envisioned that remote reading would occur during the off hours.

Figure 4 illustrates the circuitry used in the existing telephone system. When another telephone number is dialed, the relay circuitry causes a 20-cycle voltage to be applied to the selected customer's line for the purpose of ringing the bell at his location. When he releases the cradle switch by picking up the receiver the large change in impedance from that of the bell ringing circuitry is reflected back to the central office, causing the relay to flip from the 20-cycle frequency to a 48-volt, d-c voltage, which is used for powering the phone during all conversations.

It will be necessary for our Black Box II to change this sequence by not energizing the 20-cycle, bell-ringing voltage relay. This, then, would apply the 48-volt d-c, or some selected a-c voltage, directly to the phone line without ringing the customer's bell. Other than this change, the central office equipment of the telephone company may be used as is.

Keeping in mind the customer's portion of this telephone circuitry, let's see a few ways that we can utilize the circuitry by additional hardware changes at the customer's location. This leads us to Black Box I, which may be a separate unit or an integral part of the meter, or a combination of both.

Figure 5 illustrates one means of recording the number of kilowatt-hours used since the last reading. This is accomplished purely on an elapsed time basis. The method illustrated is indicative of many alternate ways to accomplish the same purpose.

In the method illustrated the storage shaft is rotated through the proper gearing by the existing meter. Upon being commanded by the telephone line circuitry the storage gear will be rotated by an accurate synchronous motor at, say, 100-cps frequency, giving us an elapsed time which is directly proportionate to the kilowatt-hours used.

Provision must be made for restoring the reading back to zero, or for restoring it to its previous posi-

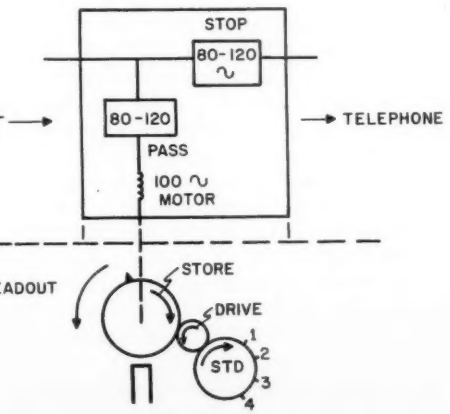


Figure 5

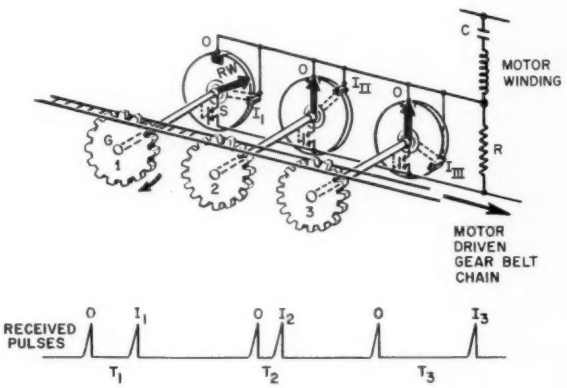


Figure 6

tion for re-reading. This would be accomplished by circuitry installed as a part of Black Box II which, in essence, releases the gearing from further storage when the correct reading is obtained.

The whole theory of reading elapsed time, and therefore power usage since the last reading, may be open to question. It is certainly the easiest method to use, giving the end product—consumed kilowatt-hours—directly rather than as the result of subtracting two larger numbers. It is obvious that other, and possibly cheaper, methods of accomplishing this may be evolved and this solution is proposed only as a typical one to be weighed against other methods both technically and economically.

Figure 6 illustrates a method for reading the four digits of the meter precisely as the meter reader would.

By a gearing mechanism crudely illustrated here in belt form, the first meter reading is obtained by rotating at a fixed rate a contact point which will eventually close a circuit at the position of the existing needle reading.

The elapsed time, as indicated in Black Box II, between the two pulses is an indication of the angular rotation of the indicating needle. Upon making contact, the second digit reading is energized and similarly, by the elapsed time method, the position of its needle is read and so on for four readings.

It is never considered to be necessary to read the fifth digit on five-digit meters, and as was noted in the description of Black Box II, the X 10 factor automatically adds a zero to the four digit reading. In essence, you are always under-reading the customer's reading by up to 10 kilowatt-hours.

This method closely parallels that performed by the meter reader. It does not, however, in this simple form contain the intelligence which he must use in order to obtain the correct reading. As those of you who have read meters know, there is often a fine line of demarcation between, let us say, the 7 and 8 on the meter. Not knowing which is the correct number in the face of parallax and other discrepancies, what do you do? The meter reader knows that he must look to the succeeding digit to determine whether the 7 or 8 figure is to be used. If the succeeding digit reads 1 or 2, then 8 is the correct reading. If, on the other hand, the succeeding digit reads 9, then 7 is the correct reading.

Often the difference in angular position of less than one degree determines as large a difference as 1000 kwhr. It is obvious from this that the system described, without improvement, is open to error. This is true of virtually every patent examined wherein each segmented reading is treated as though it were a positively placed reading rather than one containing an infinite number of positions.

In this day of computers this problem is easily solved where it should be solved, at Black Box II, the central station. It may be worked out, for example, that if our reading is 7 as obtained from the circuitry but the number is marginally close to the 8 region, the reading of 7 would be rejected unless the succeeding reading were, say, between 8 and 10. If the succeeding reading were 1 to 3 then automatically the 7 reading would be converted to 8. This is duplicating the analysis which the meter reader performs and for existing computers is a minor assignment. Since the circuitry required in the computer will exist in Black Box II, and not at the meter location, it can be tolerated economically.

Figure 7 illustrates a departure from both of the previously described systems in that it uses a digital system rather than pure analog. Again, as a departure, we have illustrated the needle as a slotted disk which may be read by the customer as easily as the needle, thereby fulfilling this important requirement. By a coating of photo-electric material on a printed circuit overlay as illustrated, we can obtain a contactless type of contact. Similar circuitry is being used today to form a contactless potentiometer. Any light —and this means that we must provide a small bulb in the meter, which will be lighted upon command—

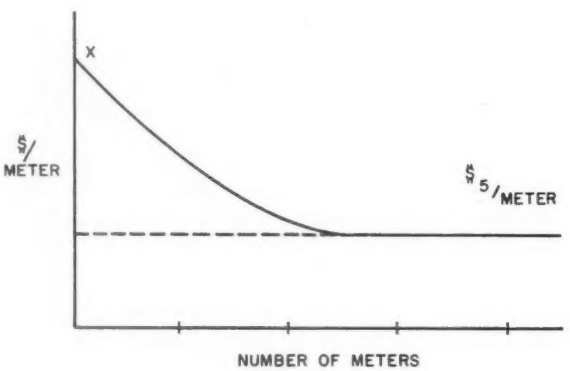


Figure 8

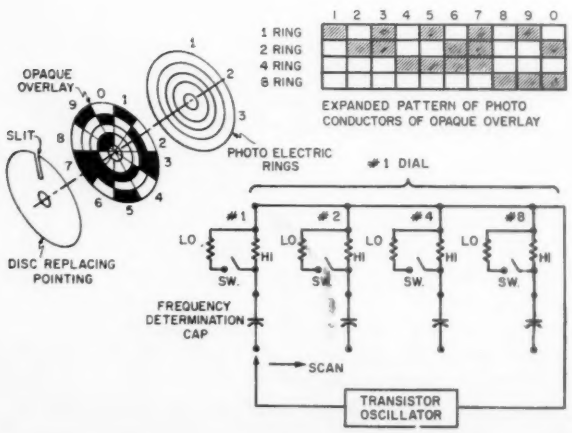


Figure 7

will cause a low impedance in the coating along the slit in the disk as compared to the inherent property of the coating which is that of a very high impedance.

The contacts thus formed give us the on and off characteristics required in the digital system. As may be seen, it is the equivalent of throwing switches on properly selected digits, thereby changing the tone of the signal applied from the central station. This tone difference is converted to the direct reading as part of Black Box II. A system such as this has to be analyzed from a service standpoint, but it has the inherent value of causing an impedance change without applied voltage, thereby being a sparkless system which is important in the consideration of gas meter reading.

Somewhere in the above three systems, or in a system similar to one of them, lies an economical

(*Continued on page* 267)

Analysis of Fatal Accidents in the Electric Light and Power Industry in 1959

By S. H. Young

The Hartford Electric Light Co.

THE number of fatal accidents in the electric light and power industry increased in 1959 to 100 from the 1958 total of 86.

This is an increase of 16.3 percent. As far back as the fatal accident records go, this "up-one-year-and-down-the-next" phenomenon has occurred. In no two consecutive years has there been improvement. There has been a general improvement over the years, however. The 100 cases in 1959 compare favorably with the 19-year average of 124 cases per year.

In 1959, the fatal electric shock and burn cases represented 59 percent of the total fatalities. This is an all-time low for the 19-year period. Perhaps the "Stop-Shock" campaign initiated two years ago by the Accident Prevention Committee is showing results. This comparison is interesting and encouraging.

	1959	*19-Year Average*	*High Year 1949*
Number of Electric Shock and Burn Fatalities	59	88	134

While fatalities from electric shock and burn were decreasing, motor vehicle cases increased from three in 1958 to 13 in 1959. The average number per year for the 19-year period is nine.

Falls Increase

Falls also were responsible for an increased number of fatalities in 1959, with 14 cases reported. In 1958 there were five cases, and the average number per year for the 19-year period was 14, the same as in 1959.

Three types of accidents—electric shock and burn, motor vehicle, and falls—must receive attention if there is to be a reduction in the number of fatalities. In spite of the reduction in number of electric shock and burn cases in 1959, electric shock and burn hazards are still the most serious problem.

A 19-year picture of fatal accidents is shown in Figure 1. Over this period 2362 fatalities occurred, of which 1678 were the result of electric shock or burn and 684 were non-electric shock or burn cases.

Electric shock and burn is the most serious problem, especially for line departments, as 44 of the victims in 1959 were linemen. Figure 2, a 10-year summary, shows among other things, where contact was made on the body.

Hot-Weather Contacts

Figure 3 gives proof that contacts made during the hot weather season are more serious. Thirty-three of the 59 cases, or 54 percent, occurred during the four months of May, June, July and August.

It was also shown that 45 fatalities due to electric shock and burn occurred between the hours of 9:00 a.m. and 4:00 p.m.

From the individual accident reports on these fatal

(*Continued on page* 264)

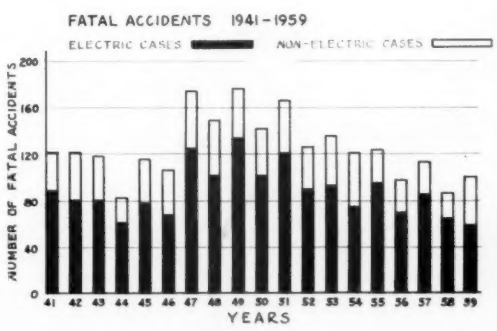


Figure 1

ELECTRIC SHOCK and BURN CASES

Review and Classification of 100 Fatal Accidents Reporte

Compiled by EEI's Accident Prevention Comm

				PATH OF CURRENT					
				VICTIM		EQUIPMENT			
				ENTRY	EXIT	ENERGIZED	GROUND OR 2ND CONT.	VOLTAGE	OCCUPATION
ELECTRIC SHOCK OR BURN	LINE WORK ON POLES 37 CASES	CONTACTS ESTABLISHED WHILE CLIMBING OR WORKING IN WORKING POSITION BUT WITHOUT CUTTING OUT OR LOSING BALANCE.	HANDS 15 CASES	R-Hand	R-Groin	Trans.Bushing	Trans.Case	Primary	Lineman
				L-Hand	R-Hand	Pri.Wire	Neutral	2400-1100	Lineman
				R-Hand	Body	Come-Along	Neut.Ground	4160-2400	Lineman
				L-Hand	R-Cheek	Xarm Brace	Capacitor Rack	4160-2400	App. Lineman
				L-Hand	Feet	Pri.Wire	Pole	8320-4800	App. Lineman
				Hands	R-Knee	Pri.Wire	Com.Neut.	12500-7200	Lineman
				R-Hand	R-Forearm	Trans.Riser	Trans.Grd.Wire	-7200	Lineman
				R-Hand	L-Leg	Pri.Wire	Sec.or Neut.	-7200	Lineman
				R-Hand	L-Hand	Trans.Neut.	System Neut.	12450-7200	Lineman
				R-Hand	L-Foot	Trans.Riser	Sec.Neutral	12400-7200	Troubleman
				R-Hand	Feet	Pri.Wire	CP Pole	12500-7200	App. Lineman
				R-Hand	Feet	Sec.Lead	Pole	-7200	Lineman
				R-Hand	R-Foot	Pri.Wire	Trans.Bolt	-7200	Lineman
				R-Hand	L-Hand	Tie Wire	Grdng.Equip.	14400-	Lineman
				R-Hand	Body	Glowtector	Tower	117000-67500	Line Foreman
			ARMS 9 CASES	L-Arm	Chest	Sec.Dead End	Serv.Messenger	240-120	Lineman
				L-Arm	Body	Sec.Wire	Sec.Wire	240-120	Line Helper
				R-Forearm	--	Pri.Wire	Pole	2400-	Lineman
				R-Arm	Groin	Come-Along	Neut.Ground	4000-	Lineman
				R-Arm	R-Foot	Block Hook	Neutral	4160-2400	Lineman
				R-Arm	L-Leg	Fuse	Guy Wire	4160-2400	Lineman
				L-Arm	R-Foot	D.E.Clamp	Pole&Grd.Wire	4800-2760	Lineman
				R-Forearm	L-Foot	Pri.Wire	Conduit	7200-	Lineman
				R-Forearm	L-Hand	Pri.Wire	Coffing Hoist	12470-7200	Lineman
			SHOULDER	L-Shoulder	R-Thigh	Pri.Jumper	Sec.Wire	12500-7200	Lineman
			HEAD 3 CASES	Head	R-Thigh-Foot	Pri.Cond.	Xarm Brace	12470-7200	Lineman
				Chin	Thighs	Pri.Wire	Guy	12500-7200	App. Lineman
				Head	L-Arm Pit	Pri. Wire	Guy	66000-	Lineman
			BODY 2 CASES	Back	L-Hand	Cutout Lead	Guy Wire	4160-2400	Lineman
				L-Arm Pit	Feet	Conductor	Pole	44000-26400	Lineman
			LEGS 2 CASES	R-Thigh	L-Shoulder	Trans.Case	Neutral	4160-2080	Lineman
				L-Hip	R-Hand	Pri.Cutout	Sec.Wire	-7200	Lineman
		POINT OF CONTACT NOT DETERMINED						240-120	Lineman
		LOST BALANCE		R-Arm	R-Leg	Pri.Wire	Sec.Neutral	2400-1385	App.Lineman
		CUTOUT		Body	Body	Pri.Wire	Pri.Wire	4000-2400	Lineman
		SLIP		R-Arm	L-Leg	Tie Wire	Neutral	4150-2400	Lineman
		SLIP		Head	Knees	Pri.Wire	Neutral	-7200	Lineman
BURN	LINE WORK ON GROUND 8 CASES			Hands	Body	Pri.Wire	Earth	-2400	Serviceman
				Hand	--	Aerial Ladder	Earth	4800-2400	Lineman
				R-Hand	Feet	Winch Line	Earth	8320-4800	Machine Oper.
				R-Hand	Feet	Line Truck	Earth	12000-7200	Lineman
				Hands	Feet	Tel. Wire	Earth	13200-	Groundman
				Hand	Feet	Truck	Earth	13200-7680	Lineman
				Hand & Body	Feet	St.Lt.Wire	Earth	Series St.Lt.	Lineman
				L-Wrist	Back & Feet	St.Lt.Wire	Earth	Series St.Lt.	Lineman
59	TREE			Hand	Feet	Pri.Cond.	Tree	8320-4800	Tree Trimmer
	UNDERGROUND 2 CASES			FLASH BURN - NO CONTACT				4156-2400	Mechanic
CASES				L-Shoulder	R-Hand-Head	Pri.Wire	Cable Sheath	4800-2400	Splicer
	AT STATIONS OR AROUND	ENERGIZED BUS		L-Hand	R-Hand	Bus	Structure	4160-2400	Electrician
		STATION BUS		L-Hand	R-Hand	Bus	Structure	23000-13200	Maint.Foreman
	EQUIPMENT BUS STRUCTURES, ETC.	DISCONNECT		--	--	Disc.Switch	--	13800-7900	Mechanic
59.0%		SWITCH		--	--	Switch	Switch	13800-	Lineman
				R-Foot	L-Arm-Foot	Disc.	Steel Struct.	-7200	Electrician
		MISC. EQUIP.		Chest	Feet	Jumper	Earth	34500-20000	Lineman
	11 CASES			R-Hand	L-Hand	CT Bushing	Steel Struct.	69000-40000	Electrician
		FLASH BURNS		NO CONTACT				NOT GIVEN	Elec. Oper.
								2300-	Electrician
								4160-2300	Wireman
								66000-	Electrician

...porte...uring 1959 Within the Electric Light and Power Industry

Comm...from Detailed Reports Submitted to the Institute

...UPATION		DESCRIPTION
...eman	1.	While belting in, contacted transformer primary bushing alive from secondary. Fall to ground fatal.
...eman	2.	Repairing down wires. Reached out to hang handline on DA bolt. Line not de-energized by cutouts opened.
...eman	3.	Reached around pole with come-along in hand. Contacted coffing hoist hook attached to line. Wearing leather gloves.
...Lineman	4.	With face against grounded capacitor rack, took hold of hot x-arm brace while belting in.
...Lineman	5.	Transferring primary to new pole without rubber gloves. Made contact between ends of line hose where hand line was fastened.
...eman	6.	Untieing dead wire, wearing leather gloves. Lineman on adjacent pole, putting line guard on jumper, caused jumper to contact wire.
...eman	7.	Wrench slipped while loosening connector on ground wire. Hand made contact on transformer primary riser.
...eman	8.	Victim hooked chain hoist on primary wire to pull slack. Victim survived the contact without resuscitation but burns were fatal.
...eman	9.	Removing cutout due to conversion to 12,450 WYE. Opened transformer neutral. Did not jumper out cutout.
...ublеman	10.	Made contact while belting in. Not wearing rubber gloves. Fell to ground.
...Lineman	11.	Made contact while placing 4 foot chain over top of pole to raise transformer.
...eman	12.	New transformer energized to check voltage. HV lead inside trans. in contact with sec. breaker. Secondary alive at primary voltage.
...eman	13.	Victim's rubber glove struck by associate's climber. Glove examined for damage but not replaced. Contact made through damaged glove.
...eman	14.	Removing grounding set from 46 KV circuit. Made contact on 14.4 KV circuit located 6' below. Not wearing rubber gloves.
...e Foreman	15.	To prove glowtector, tested it on adjacent live line. Extension handle not used due to broken end. Glowtector exploded.
...eman	16.	Pulling slack on 3-wire sec. service to slide bail back on insulator. Arm above elbow contacted bail while chest was against messenger.
...e Helper	17.	Belted in at secondary x-arm. Reached out to clear handline. Received 240 volt shock.
...eman	18.	Reached over top x-arm to unhook blocks. Contacted uncovered primary.
...eman	19.	Transferring primary to new pole. Reached under x-arm to remove jumper. Made contact.
...eman	20.	Reached for rope sling. Made contact on hook on block attached to wire on which slack was being pulled. No rubber covering used.
...eman	21.	Reached around pole while belting in. Made contact on bottom of fuse holder. Not wearing rubber gloves or sleeves.
...eman	22.	Had finished making hand held ammeter test on primary. Made contact, no protective covering used.
...eman	23.	Placing line hose on primary leads to 3 phase transformer bank. Reached across uncovered delta bus.
...eman	24.	Restoring down primary. Made contact on live wire while checking slack in wire just pulled in.
...eman	25.	Reached over secondary arm to connect secondary to new transformer. Made contact on unprotected primary jumper.
...eman	26.	Made contact while removing line hose from primaries. Line hose removed in wrong sequence.
...Lineman	27.	Clearing trouble. Opened one fuse cutout. Primary still hot from backfeed through secondary and transformer.
...eman	28.	One of two circuits, in vertical configuration, on 2 pole structure, dead and grounded. Climbed pole and made contact on live circuit.
...eman	29.	Leaned through under sec. x-arm to free transformer gin stick being lowered from snag on pole step. Not wearing rubber gloves.
...eman	30.	Tieing in conductor to insulator. Line re-energized without clearing workmen. Workmen field grounds not used.
...eman	31.	Climbed pole between transformers. Made contact on transformer case that was hot, while in contact with uncovered neutral.
...eman	32.	Replacing secondary, failed to open primary cutout, contacted cutout.
...eman	33.	On pole below secondary wires. Cried out. Unbuckled safety belt and started down pole. Fell backwards off pole.
...Lineman	34.	Lost balance and overreached primary he was to untie. No protective covering on secondary.
...eman	35.	Working on dead 16 KV overbuilt line. Cutout and fell on uncovered primary below.
...eman	36.	Possibly slipped while removing line hose from primary. Protection had been removed from common neutral.
...eman	37.	Boring hole to mount bracket. Probably slipped while changing position. Not wearing rubber gloves. No rubber protection.
...vicеman	38.	Patrolling line for trouble. Contacted down wire hidden in underbrush.
...eman	39.	Apparently touched ladder truck while standing on ground at time ladder was extended in primary area.
...hine Oper.	40.	Digger moved with boom extended. Victim holding winch line. Boom contacted line.
...eman	41.	Victim operating hydraulic digger on truck derrick. Top of derrick contacted primary.
...undman	42.	Reeling telephone wire, being removed, on truck reel. Wire raised up into primary.
...eman	43.	Attempted to open truck door when pole being set with hydraulic boom contacted line.
...eman	44.	Street light wire down during storm. Victim slipped in ditch and fell. Grasped wire.
...eman	45.	Attempting to loop rope around down wire. Wind blew wire against victim.
...e Trimmer	46.	In tree cutting branch with pruners. Lost balance and contacted wire.
...hanic	47.	Tieing in new service. Mistook untagged primary cable for secondary in street splicing box.
...icer	48.	Installing cable terminal on pole. Made contact on uncovered primary wire.
...ctrician	49.	Upon completing work in de-energized part of substation, victim made contact in unbarricaded live section.
...nt.Foreman	50.	Inspecting fitting on base of air break switch from ladder. Flash occurred. Victim fell 15' to ground.
...hanic	51.	Making inspection of disconnect switches. Contacted live equipment. No voltage tests made.
...eman	52.	Climbed onto switch structure to phase out cable. Contacted live part of switch.
...ctrician	53.	Climbed structure to work area to connect in pothead. Moved into energized bay.
...eman	54.	Hot line clamp slipped out of hot stick holder. Jumper swung against victim.
...ctrician	55.	Victim after completion of his assignment moved over into energized area and made contact on CT that earlier had been out of service.
...c. Oper.	56.	Victim apparently opened live circuit breaker compartment and caused short circuit.
...ctrician	57.	Lowered tank on oil switch with one side energized. Wrench caused short circuit and flash.
...eman	58.	Ringing out cable from unit substation. Contacted bus terminal instead of de-energized cable terminal.
...ctrician	59.	Electric drill being raised on handline. Drill cord swung into live bus.

NON-ELECTRIC SHOCK and BURN CASES

				OCCUPATION
FALLS	LINE WORK	FALL FROM POLE	Line pole with transformer.	Lineman
			45' pole with transformer.	App. Lineman
			50' pole with 3 - 3 KVA trans.	Lineman
			Feeder disconnect pole.	Lineman
			40' STP treated joint pole.	Lineman
14			50' pole with transformer.	Troubleman
CASES	10 CASES	FALL WITH POLE	30' used TP pole - reset.	Lineman
			30' pole with sec. racks	Lineman's Helper
			35' creo. pine pole.	Lineman
			Customer's 25' service pole.	App. Lineman
	FALL WHILE WASHING INSULATORS		Truck with boom and basket.	Ins. Washer Forema
14.0%	FALL TO CONCRETE FLOOR		At Hydro-Generating Station.	Maint. Man
	FALL FROM STATION STRUCTURE		Electric Station.	Meterman
	FALL FROM STATION BUS STRUCTURE		Hydro-Generation Plant.	Electrician
STRUCK BY	PASSING MOTOR VEHICLE		Restoring service along highway.	Lineman
	CLAM SHELL		Unloading coal from gondola.	Unloader
4 CASES	STONE AND BRICKS		Working on stage suspended from roof.	Maint. Man
4.0%	6 X 6 TIMBER		Pulling in cable to vault.	Cable Foreman
CAUGHT IN	TRACTOR		Rough terrain at ravine.	Equip. Oper.
2 CASES	JEEP		Plant drive.	Foreman
2.0%				
DROWNED	RIVER AT GENERATING STATION		Working on oil barge.	Operator
2 CASES	LOCATING FAULT ON SUBMARINE CABLE		Working from barge.	Helper
2.0%				
MOTOR	AT STREET INTERSECTION		Struck on left side by 2nd vehicle.	Meter Reader
	ON HIGHWAY		Collision involving two other motor veh.	Truck Driver
	ON HIGHWAY		Same as Case No. 83.	Lineman
VEHICLE	ON HIGHWAY		Collision with MV and retaining wall.	Surveyor
	ON HIGHWAY		Collision with second Motor Vehicle.	Serviceman
	ON HIGHWAY		Ran off highway.	Serviceman
	ON HIGHWAY		Ran off road into enbankment.	Foreman
13	ON COUNTRY ROAD		Ran off road.	Groundman
	ON HIGHWAY		Struck by Semi-trailer.	Collector
CASES	HIGHWAY AT RAILROAD CROSSING		Truck struck by train.	Lineman
	HIGHWAY AT RAILROAD CROSSING		Truck struck by train.	Lineman
	HIGHWAY AT RAILROAD CROSSING		Truck struck by train.	Lineman
13.0%	HIGHWAY AT RAILROAD CROSSING		Truck struck by train.	Equip. Oper.
BURNED	ON UTILITY POLE		Hot oil from Pri. oil filled cutout.	Lineman
4 CASES	AT GENERATING STATION		Hot fly ash.	Fireman
	ELECTRIC MANHOLE IN STREET		Burning gas.	Splicer
4.0%	ELECTRIC MANHOLE IN STREET		Burning gas.	Splicer
MISC.	CEREBRAL HEMORRHAGE		Exact cause not ascertained.	Meter Reader
2 CASES	CORONARY		Slipped and fell in ditch.	Lineman
2.0%				

(*Continued from page* 261)

accidents, the following information was obtained:

Age of Victim	Field Work	At Stations
Less than 25 years	3	—
26–30 years	14	4
31–35	16	1
36–40	6	—
41–45	3	1
46–50	1	2
51–55	4	2
56–60	—	—
61–65	—	1
Age not given	1	—
Total	48	11

Experience (years on work being performed).

	Field Work	At Stations
Less than 1 year	4	—
2– 5 years	17	5
6–10	18	—
11–15	5	5
16–20	2	—
21–25	1	—
26–30	—	—
31-35	1	—
Not given	—	1
Total	48	11

	DESCRIPTION
60.	Fell 38' to ground while belting in. Apparently did not check that snap engaged "D" ring.
61.	Unbelted to move down below secondaries. Lost consciousness and fell to ground. No indication of electric contact.
62.	Standing on secondary buck arm connecting transformer. Unbelted to shift position and fell.
63.	Climbing ice covered pole to open disconnects with safety strap around pole. Cutout and slid 31' to ground.
64.	Unbelted to change position. Both spurs cutout. Fell approximately 25' to ground.
65.	Climbing snow covered pole to pull transformer fuses. Apparently hand slipped Fell 28' to ground.
66.	Pole broke off at ground line while pulling slack on st. lt. wire. Pole checked in yard by victim and foreman before taking to job.
67.	Adding a secondary bracket. Pole broke off, falling toward victim. Casual test would have shown pole unsafe.
68.	Boring hole for secondary clevis. Pole broke off 10" below ground level. Service wires at building end had been detached.
69.	Pulling slack on secondary service. Pole pulled loose from building and out of ground and fell on victim.
70.	Boom gave way and fell to ground with employee in basket. Equipment failure.
71.	Victim found at foot of penstock after falling. Reason for fall unknown.
72.	Installing current transformers. Disengaged safety strap to change position, lost balance and fell.
73.	Slipped while standing on steel structure. Fell 54 feet to ground. Not belted in.
74.	While working at scene of trouble, victim struck by car operated by intoxicated driver.
75.	Victim quickly walked between clam shell and side of car as operator moved clam shell on signal.
76.	Parapet wall and brick work gave way allowing scaffold and men to fall to ground. Skull fractured by falling brick and stone.
77.	While winch line was under tension, rigging gave way. Timber struck victim in head.
78.	Operator stopped tractor on grade and stepped on track. Tractor rolled into ravine. Caught between track and hydraulic support arm.
79.	Disengaging tow chain between stalled car and Company jeep. Jeep rolled and pinned victim between vehicles.
80.	Last seen by employee he relieved as he stepped onto barge. Found to be missing approximately one hour later.
81.	Wearing aqua-lung to locate fault in submarine cable. Walked out approximately 20' from barge and disappeared.
82.	Company vehicle thrown to sidewalk. Victim thrown out striking head on hydrant.
83.	Car after passing Company truck on icy road went out of control causing collision.
84.	Riding on truck involved in Case No. 83.
85.	Company car in which victim was passenger skidded on wet oil slick, crossed road into oncoming car.
86.	Company truck made left turn in front of car from opposite direction. Victim thrown out of truck.
87.	Ran off road at curve and struck tree. No skid marks made, indicating diverted attention.
88.	Lost control of pick-up after passing car. Crashed into embankment. Thrown out and crushed by pick-up.
89.	Pneumotractor rolled over upon leaving road. Victim thrown to road, sustaining skull fracture.
90.	Company vehicle struck in left rear by passing vehicle when company driver apparently backed vehicle close to or on traveled lane.
91.	Returning to job site after lunch. Truck struck by fast train at unguarded crossing. Four of crew fatally injured.
92.	(Same as No. 91)
93.	(Same as No. 91)
94.	(Same as No. 91)
95.	Transferring load on 4160 V primary feeder. Rope on blocks and falls turned cutout in on short. Fatal burns from burning oil.
96.	Cleaning stack. Fly ash belched out of trap door. Victim jumped from platform into truck of hot fly ash.
97.	Extensive burns when gas in manhole ignited. Failed to make test for gas.
98.	Testing for gas leak. Entered manhole and apparently connected test lamp for illumination.
99.	Had previously been ill and had undergone an operation for fractured elbow sustained in fall on customer's premises.
100.	Coronary occlusion as a result of complications following fractured hip and operation.

Weather conditions—In most cases the weather was fair as this list shows.

	Field Work	At Stations
Fair or Clear	36	9
Cloudy	5	1
Hot–Humid	2	—
Rain	4	—
Not given	1	1
Total	48	11

Reasons given on the individual accident reports as the cause of accident.

	Field Work	At Stations
Unsafe act by injured	37	7
Unsafe act by others	1	1
Safety rules not followed	36	6
Improper work method	24	6
Improper supervision	18	2
Equipment failure	4	1

Compliance with individual company's rules regarding use of protective equipment.

Required but not used	Field Work	At Stations
Rubber Gloves	19	—
Rubber Sleeves	9	—
Rubber Blankets	9	—
Line Hose	15	—
Insulator Hoods	8	—
Cutout Covers	2	—
Rope Barriers	2	1

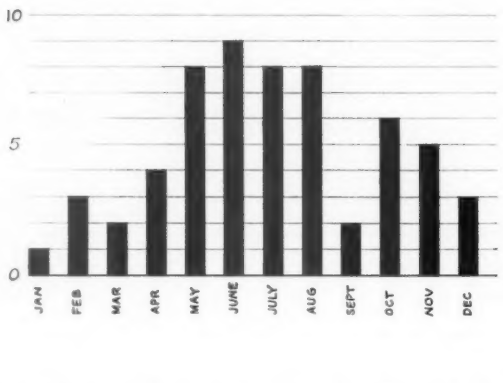
ELECTRIC SHOCK AND BURN FATALITIES
TEN YEARS 1950 - 1959

Figure 2

		1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	TOTAL
LINE WORK ON POLES	Contacts made while climbing or in working position without pulling out or losing balance.											
	Hands	25	26	26	14	25	27	16	24	17	15	215
	Arms	14	19	11	11	6	16	8	6	7	9	107
	Head	7	1	7	7	5	5	2	1	1	3	39
	Neck	0	1	0	2	2	2	0	0	0	0	7
	Body	5	4	1	7	4	4	2	5	3	2	37
	Shoulder	0	4	3	4	0	4	4	6	0	1	26
	Leg or Foot	3	1	1	3	1	0	4	2	1	2	18
	Unknown	2	5	2	0	0	0	0	3	0	1	13
	Flash	0	2	1	3	3	4	2	0	1	0	16
	Gaff Cutouts	3	5	4	2	0	0	0	1	1	0	16
	Slips & Lost Balance	0	0	0	2	1	3	1	0	2	4	13
	Possible Heart Case	0	0	0	0	0	0	1	1	0	0	2
	Line Work from Ladders	1	1	0	0	0	0	0	0	0	0	2
	Line Work from Hyd.Tower	0	0	0	0	0	0	1	2	1	0	4
	Line Work in Trees	0	0	0	2	1	1	1	1	0	1	7
	Line Work on Ground	9	9	10	9	6	2	5	15	8	4	77
	Surveying	0	0	2	0	0	1	0	0	0	0	3
	St. Light Replacement	0	0	0	0	2	2	0	0	0	0	4
	Energ. Cranes & Trucks	0	3	1	2	0	3	4	5	4	4	26
	Underground	2	0	2	0	1	6	1	0	1	2	15
	In Basements	0	2	0	2	1	0	0	0	1	0	6
TOTAL OF ABOVE		71	83	71	70	58	80	52	72	48	48	653
AT STATIONS & REPAIR SHOPS		31	38	19	23	17	15	18	14	17	11	203
TOTAL		102	121	90	93	75	95	70	86	65	59	856

Figure 3

ELECTRIC SHOCK AND BURN CASES
MONTH OF OCCURRENCE



Lineman's Platforms	1	—
Portable Grounds	9	2
Safety Hats	2	1
Goggles	2	1
Special Line Covering	1	—

It is the hope of the Accident Prevention Committee that these summaries of facts, compiled from the individual reports on the fatal accidents, will be widely circulated among the employees of our companies and in the future many serious accidents may be avoided through their knowing what did happen to 100 employees in the electric utility industry in 1959.

TABLE I—NINETEEN YEARS OF FATAL ACCIDENTS IN THE ELECTRIC LIGHT AND POWER INDUSTRY—1941 TO 1959 INCLUSIVE
(From EEI Accident Prevention Committee summaries based on detailed reports received.)

Year	*Total*	*El. Shock or Burn*	*Falls*	*Motor Vehicles*	*Struck By*	*Burned*	*Caught In*	*Drowned*	*Miscellaneous*
1941	121	90	11	8	4	2	3	1	2
1942	121	81	19	11	6	3	0	0	1
1943	117	81	14	3	7	5	1	3	3
1944	82	62	6	5	6	1	2	0	0
1945	116	79	14	6	5	4	3	3	2
1946	105	68	19	8	5	0	2	2	1
1947	173	125	20	8	13	3	2	1	1
1948	149	102	21	13	6	2	2	0	3
1949	176	134	16	13	6	1	5	1	0
1950	141	102	13	9	4	4	0	5	4
1951	165	121	21	8	4	4	1	5	1
1952	125	90	7	17	4	0	1	1	5
1953	134	93	18	12	6	1	0	0	4
1954	120	75	17	14	6	0	2	0	6
1955	122	95	12	0	5	2	1	3	4
1956	97	70	10	6	4	2	2	3	0
1957	112	86	11	6	2	4	1	1	1
1958	86	65	5	3	3	1	6	2	1
1959	100	59	14	13	4	4	2	2	2
19-Year Total	2362	1678	268	163	100	43	36	33	41

Distribution of Accident Types (By Percentages of Total Accidents)

	1959	*19 Year-Average*	*19 Year Range Min.*	*Max.*
Electric Shock or Burn	59.0	71.0	59.0	77.9
Falls	14.0	11.4	5.4	18.1
Motor Vehicles	13.0	6.9	0.0	13.2
Struck By	4.0	4.2	1.8	7.5
Burned	4.0	1.8	0.0	4.3
Caught In	2.0	1.5	0.0	7.0
Drowned	2.0	1.4	0.0	3.5
Miscellaneous	2.0	1.8	0.0	5.0

Remote Reading of Electric and Gas Meters

(*Continued from page* 360)

solution to providing a reading of the customer's meter at a remote, central location. To say that this can be done technically will lead to little argument. Whether or not it can be done within the stated economic requirements appears to us to be the major problem. For instance, the installation cost which has been quoted at a $5-per-meter maximum might eventually become $5 but most probably would not commence at the $5 level.

Figure 8 shows that the first meter installations would be made at a cost of X dollars for installation, with a slope similar to that shown eventually reaching the $5 level after a number of installations are made. When the number runs in the millions, much can be done toward cost reduction.

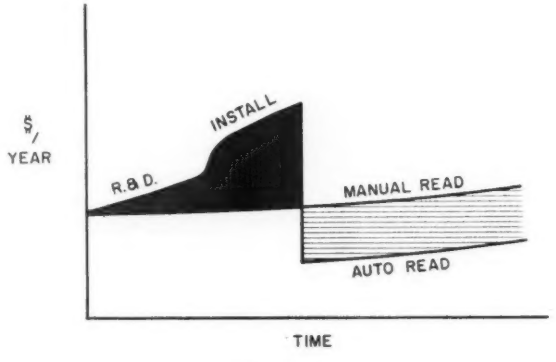


Figure 9

Figure 9 indicates the trend which the electric utility industry will face if remote reading is contemplated. The line listed as manual shows the annual cost for reading meters, which has a slight upward trend reflecting increased wages on an annual basis.

While this cost is being met, there will be a cost for research and development experienced by the industry. This, as shown, is additional to the continuing manual reading existing for a period of time yet undefined. Following the decision to go ahead there will be, as shown, a period of time during which installations and modifications are made at the customers' locations.

The amount of expenditure over and above the manual reading cost during this period is illustrated by the area above the manual reading curve. This is a direct loss, or an investment in the future, whichever way your company considers it. At the time when the installation is complete we now eliminate the manual reading and the cost of the remote reading is shown as substantially less than the cost for manual reading. This results in the green colored area denoted in Figure 9 as savings in cost of reading meters. This savings is a perpetual one. At some time in the future the horizontally lined area, representing savings, will equal the vertically lined area, representing loss, and from that time forward a direct savings will result.

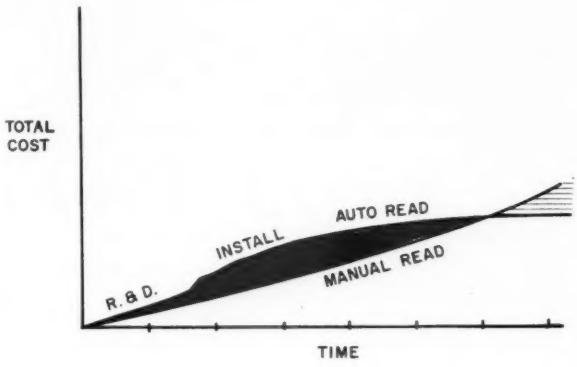


Figure 10

Figure 10 presents virtually the same information in cumulative form with the vertically lined area indicating loss and the horizontally lined area savings. The same comments apply. It would appear that this is the financial approach which you must eventually take—again very similar to the diesel versus steam locomotive. At some time in the future, I am sure that we will all wonder why automatic reading wasn't accomplished a long time ago.

The Fairchild Astrionics Division recognizes that the task of economically reading meters from a remote location presents a challenge. We see the initial problem as one requiring an exhaustive study of the economics associated with each feasible technical solution. We have the technical experience but must draw upon the electric utility industry for environmental information and support. If it can be agreed that remote power meter reading is potentially rewarding but difficult, then it is deserving of an all-out assault rather than the piece-meal approaches of past years.

A Complete List
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Available from:
Edison Electric Institute
750 Third Avenue
New York 17, N. Y.

Baltimore G&E Tops 9 Million Hours; Two Departments of Consolidated Edison Get 4-Million-Hour Awards

48 Awards Presented for Safety Achievement

IN the six-month period, Jan. 1 to June 30, 1960, EEI presented 48 Safety Achievement Awards to 25 member companies for attaining 1,000,000 or more accident-free man-hours of operation.

During this period, the Power Transmission Stations of Baltimore Gas and Electric Co. established an all-time accident-free record of 9,006,949 man-hours of operation. This is a record which no other member company has approached, and spans more than 20 years.

Two departments of Consolidated Edison Co. of New York, Inc., in the first half of this year reached the 4-million man-hour mark without accidents. They were the Station Construction and Shops—Mechanical Construction Bureau, and the Commercial Buildings Department—Operation Bureau. A 3-million man-hour certificate also was awarded to Consolidated Edison's Station Construction and Shops—Electrical Construction Bureau.

The General Sales Department of New Orleans Public Service, Inc. also was awarded a 3-million man-hour certificate.

Five departments of three member companies received Safety Achievement Awards from EEI for attaining 2-million or more man-hours of operation without a disabling accident. They included Electric Operations and Southern Division of Alabama Power Co.; Electric Distribution Department—Underground Lines Division of Baltimore Gas and Electric Co.; and Northern Division and Entire Company of Pennsylvania Electric Co.

The 1,334,000 man-hours achieved by Georgia Power Co.'s Manchester District personnel without a serious accident represents 23 years of safety for its 29 employees. This is the only department of any member company to extend its safety record over 23 years.

Following is the list of 48 awards presented from Jan. 1 to June 30, 1960:

Alabama Power Co.
- Electric Operations 2,395,603
- Southern Division 2,001,942
- Birmingham Division 1,042,298
- Phenix City District 1,057,979
- Gorgas Steam Plants 1,000,115
- Lay Dam Employees 1,000,017

Baltimore Gas and Electric Co.
- Power Transmission Stations 9,006,949
- Building Service & Real Estate Departments 1,000,228
- Electric Distribution Department—Underground Lines Division 2,007,452
- Electric Operating Departments 1,009,846

Central Hudson Gas & Electric Corp.
- Upper Hudson Operating District—Kingston Electric Group 1,001,945

Commonwealth Edison Co.
- Underground—Chicago Central 1,000,000

Connecticut Light & Power Co.
- Bristol District 1,024,256

Consolidated Edison Co. of New York, Inc.
- Station Construction & Shops—Mechanical Construction Bureau 4,000,000
- Production Department — Hudson Ave. and Gold St. Stations 1,000,000
- Commercial Buildings Department—Operation Bureau 4,000,000
- Station Construction & Shops—Electrical Construction Bureau 3,000,000
- Outside Plant Construction Department—Coordinating Bureau 1,000,000
- Purchasing & Stores Department — Stores Bureau 1,000,000

The Detroit Edison Co.
- Construction & Maintenance Department 1,000,914
- Electrical Apparatus Division—Electrical System Department 1,000,000
- Relay Division—Electrical System Department 1,005,556

Florida Power Corp.
- Entire Company 1,185,110

Georgia Power Co.

Manchester District	1,334,000
Gulf States Utilities Co.	
Louisiana Station	1,000,000
Neches Station	1,000,000
Idaho Power Co.	
Entire Company	1,151,492
Iowa Public Service Co.	
East Division	1,104,632
Kansas Gas & Electric Co.	
Entire Company	1,018,590
Kentucky Utilities Co.—Old Dominion Power Co.	
Entire Company	1,058,766
System Power Stations	1,390,501
Long Island Lighting Co.	
Electric System Operations Department	1,004,292
Overhead Lines & Service Department—Queens-Nassau Division	1,017,514
New Orleans Public Service Inc.	
General Sales Department	3,000,000
Power Division—Electric Department	1,000,000
Ohio Power Co.	
Muskingum River Generating Division	1,000,000
Pennsylvania Electric Co.	
Entire Company	1,061,272
Northern Division	2,026,232
Northwestern Division	1,131,186
Entire Company	2,248,078
Philadelphia Electric Co.	
Entire Company	1,476,417
Engineering Department	1,135,512
Portland General Electric Co.	
Electrical Maintenance & Construction Department	1,000,000
Potomac Electric Power Co.	
Benning Generating Station	1,000,564
Public Service Co. of Colorado	
Entire Company	1,041,183
Texas Electric Service Co.	
Big Spring Transmission Division	1,000,158
Texas Power & Light Co.	
Entire Company	1,224,186
Wisconsin Electric Power Co.	
Extension System—Northern Division	1,000,000

Training Course Available on Electric Heating

"COMFORTABLE Electric Warmth—for the Entire Home" is the title of EEI's all-new flip chart sales training course on home electric heating. The course, considered to be the most comprehensive one of its kind yet devised, is now ready for distribution to electric utility companies and trade allies.

The charts which make up the course are designed as an information course for utility employees, architects, contractors, etc., and as a sales training course for all who sell electric heating. Electric utility companies will find the course extremely helpful in their employee training programs and sales training programs.

"Comfortable Electric Warmth" is a comprehensive study of the many benefits of electric home heating and was created to suggest ideas and ways to sell electric heating. The course emphasizes ductless-type electric heating and is non-technical in its approach.

The Home Heating Program comes in three forms: Complete Electric Heating Sales Training and Information Course, $75; Electric Heating Information Portion only, $50; Combination of Electric Heating and Appliance Sales Training Courses, $149.50.

An illustrative brochure describing the courses is available by writing to Sales Division, Edison Electric Institute, 750 Third Ave., New York 17, New York.

Thomas G. Dignan

THOMAS G. DIGNAN, President of Boston Edison Co., and a member of the EEI Board of Directors, died of a heart attack July 29. He was 61 years old.

A lawyer with a 32-year career in the electric utilities field, Mr. Dignan joined Boston Edison in 1951 as executive vice president. The same year he was elected president, general manager and director.

Mr. Dignan was elected to the EEI Board of Directors in 1954 and again in 1960. He also served the Institute as a member of its Executive Committee and Advisory Committee.

He attended Holy Cross College and the Boston University Law School. He was admitted to the Massachusetts Bar in 1924 and, after four years of private law practice, became assistant general counsel of the New England Power Association. He later became its secretary.

Going into the operational end of the business, Mr. Dignan next was manager of the Lowell Electric Light Co., and president and general manager of the Worcester County Electric Light Co.

He was active in many business, civic and philanthropic organizations. He was a trustee of Boston University, the Civic Education Foundation, Holy Cross College and the Suffolk Franklin Savings Bank.

EEI Research Projects

(*Continued from page* 252)

23. Wood Pole Tests

The former test data, on which has been based the accepted fibre strength of wood poles of various species, have been deemed inadequate and inconsistent. A very substantial portion of electric utility investment is found in such poles, and accurate information on their dependable design strength is of considerable economic significance. This project, initiated in 1954, was directed toward investigating methods of testing poles for strength, determining pole strength values for various species including those on which little data were previously available, studying the factors which affect pole strength, and establishing simplified methods for ascertaining fibre strength values. The testing work, which was done at the U. S. Forest Products Laboratory, has been completed and the final report is being prepared.

The project has been sponsored by the American Society for Testing Materials, and supported financially by pole producers, pole treaters, pole consumers, including EEI, and other interested agencies. Liaison has been through the Transmission and Distribution Committee.

24. Corrosion Research Council

The Corrosion Research Council of the Engineering Foundation is charged primarily with the responsibility for actuating basic scientific studies in corrosion. Its specific projects include such subjects as "Mechanism of Stress-Corrosion Cracking of Metals," "Fundamental Corrosion Reactions at the Surfaces of Metals," and "The Mechanism of the Dissolution of Metals."

The sponsors of the council are the American Institute of Mining, Metallurgical, and Petroleum Engineers, the Intersociety Corrosion Committee, the National Association of Corrosion Engineers, and the Electrochemical Society.

EEI has contributed financial support since 1955, with liaison through the Prime Movers Committee.

25. Welding Research Council

The Welding Research Council of the Engineering Foundation was organized 25 years ago to conduct needed cooperative research in welding and closely allied fields, to disseminate research information, to promote welding research in the universities, and to provide means for cooperation, interchange of ideas, and information, with similar agencies abroad. It has made important contributions to developments in welding in its various phases. The electric utilities are at present particularly interested in those activities pertaining to welding of metals exposed to high-pressure, high-temperature steam.

The council is sponsored by the American Welding Society, the American Institute of Electrical Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Civil Engineers, the American Society for Testing Materials, the American Society of Mechanical Engineers, the Society of Naval Architects and Marine Engineers, and the American Society for Metals.

Liaison with the council's work is through the Prime Movers Committee.

26. Soil Thermal Resistivity

The load-carrying capability of underground cables is dependent upon the dissipation of the heat of electrical losses from them into the soil. In the past, loading limits have been determined by the use of empirical "Duct Heating Constants" but there has been a lack of information on overall basic theory. This is needed if the most economical designs for new cable installations and the most economical loading for existing cables are to be attained.

This project, started in 1955, has involved a study of the various factors which affect soil thermal resistance, such as soil texture, moisture content, moisture migration under thermal gradients, etc. It has been carried on at Princeton University. Laboratory work has been completed and some results published, but a final report is not yet available. It is expected that an industry report on soil thermal resistivity, based on this work, will be presented to the American Institute of Electrical Engineers this summer.

The project has been sponsored by the American Institute of Electrical Engineers, through its Subcommittee on Insulated Conductors, and supported financially by EEI, AEIC, and by the cable manufacturers. Liaison has been through the Transmission and Distribution Committee.

27. Effect of Temperature on the Properties of Metals

The Joint ASME-ASTM Committee on the Effect of Temperature on the Properties of Metals has been working since 1924 on the accumulation, evaluation, and dissemination of data on the engineering properties of metals at high and low temperatures, and the standardization of test methods pertaining thereto. For a number of years it has had projects directed particularly to the study of the creep-rupture properties of certain sheet metals, to the effect of stress concentration on fatigue of metals at high temperatures, to the publication of high-temperature creep data, and to the determination of high-temperature properties of cast iron, in all of which utilities have an interest. A large amount of work has been done and information published.

EEI has contributed generally to this work, with liaison through the Prime Movers Committee. At the present time the Institute is supporting specific Joint Committee projects described in Item 21 above.

28. Corrosion and Deposits from Combustion Gases

The deposit of ash from burning coal or oil, and the condensation of corrosive vapors, on boilers, economizer, and air heater surfaces of steam boilers and gas turbine blades have been a troublesome and costly element in the operation of such equipment. This project comprises the collection, critical examination, and summarizing of all pertinent available informa-

tion in this field, in preparation for formulation of a further program of specific investigation and research. It was started in 1957 and completed with a report in 1958. Three proposals for research are now under consideration by the sponsor.

It was sponsored by the American Society of Mechanical Engineers through its Research Committee on Corrosion and Deposits from Combustion Gases. EEI has supported it financially, with liaison through the Prime Movers Committee.

Meter & Service Committee Meeting

- *New Types of Metering Equipment*
- *Joint Industry Standards*
- *Engineering, Economic, Operation Aspects*

C. P. STAHL
Chairman

APPROXIMATELY 95 members, correspondents, and guests convened at the Loraine Hotel in Madison, Wis., April 23-25, for the joint committee meeting of the AEIC and EEI Meter and Service Committees. The meeting was devoted to the discussion of new developments in meters and metering equipment; development and review of joint industry standards concerning metering; presentation of subcommittee reports; and round table discussions on the engineering, economic, and operation aspects of revenue metering.

At the Monday morning session manufacturers described and displayed new types of meters, metering instrument transformers, and metering accessory equipment. On Monday afternoon the four subcommittees met independently to discuss their various subjects and formulate their reports. E. B. Hicks, Chairman of Subcommittee I, Services, moderated this session. W. D. Lindsay in his capacity as Chairman conducted the meeting of Subcommittee II, Metering. The work of Subcommittee III, Performance, was directed by its Chairman, W. H. Farrington. The meeting of Subcommittee IV, Management, was moderated by Chairman A. D. Irion.

At a joint luncheon of the committees on Tuesday, C. J. Forsberg, President of the Wisconsin Power and Light Co., welcomed the committees to Madison. He congratulated the members and manufacturers for their continued efforts to obtain an accurate metering device at a nominal cost.

Mr. Forsberg pointed out that the electric meter is one of the prime customer relations contacts established between the customer and the company. He said it was a major responsibility of meter department managers to maintain good customer relations.

A. W. Rauth presented the 1959 report of the AEIC Meter and Service Committee. This report dealt primarily with the committee work on standardization, the development of a trend toward selective testing or statistical analysis, the general improvement and long-life expectancy of watthour meters, the trend toward mechanization of record keeping, and the overall performance improvement in meter departments throughout the country.

J. A. Morris presented a report on selective testing of revenue meters based on statistical plans. Mr. Morris pointed out that the purpose of the application of statistical methods to routine meter testing was not primarily to effect a saving for the operating company, but to provide the customer with better service at no essential increase in cost by concentrating efforts on those classes of meters which are most in need of close surveillance and adjustment, or replacement. He said that all the selective testing plans utilizing statistical methods were essentially in agreement but the details of application were a matter for study by companies.

Mr. Morris advised the committee that various industry groups were interested in selective testing plans and that the National Bureau of Standards had been approached by some groups and had agreed to make a study and recommend a generalized plan for selective testing.

G. F. Austin described briefly the selective meter test plan recently approved on a tentative basis by the Public Service Commission for use by Public Service Co. of New Hampshire. This plan is a variation of the one prepared by the New England Meter Engineers and described by E. F. Blair at the April, 1959, meeting in St. Louis.

S. B. Vaughn described a selective testing plan submitted to the state commission by Florida Power Corp. This plan is general in nature and based on the military standard. It includes variables and attributes, but omits mention of bar X or similar references.

F. L. J. Hammerle reported that he was distributing the revisions to the manual, Public Utility Commission Rules and Regulations for Electric Meters, as they became available. He advised that in those areas where selective test programs for revenue meters had been permitted on a trial basis for a specified time, he awaited final approval before initiating a change in the manual.

C. V. Morey presented a progress report on ASA C-12 and the revision of the Code for Electricity Meters. He said all groups were very cooperative, but work was progressing slowly.

J. S. Lineback said he and A. W. Rauth were cooperating with a task force of the Accounting Com-

mittee in regard to remote or automatic reading of meters He advised there was considerable general interest in the subject at this time.

L. W. Garrand of the Astrionics Division of the Fairchild Engine and Airplane Corp. described various possibilities of accomplishing remote reading of revenue meters; Mr. Garrand's paper appears in complete form on page 257 of this issue of the EEI BULLETIN.

W. D. Lindsay reported that MSJ-4, Standards for Thermal Demand Meters, had been completed and copies were available on order from EEI headquarters.

L. C. Ramon and G. B. M. Robertson informed the committees that MSJ-10, Standards for Watthour Meters, had been completed and approved by both the Meter and Service Committees and the Triple Joint Committee on Watthour and Demand Meters. This standard will be printed by EEI and copies will be available.

Tape-type demand recorders were discussed by S. B. Vaughn. He reported that a questionnaire disclosed that out of 50 companies reporting, 34 are using the recorders for billing, 25 for load studies, 25 in plants and substations, and four are using them for other types of recording. E. F. Blair pointed out that the industry really needs two devices with different characteristics —one for load survey work, and the other for revenue metering.

C. L. Hockman reported that the majority of the committee favored use of the ratio 2.5 to 1 as a standard for 277/480-volt class potential transformers.

A report on terminology and application of contact devices was presented by E. L. Keller.

L. C. Ramon disclosed that New Orleans Public Service Inc. is encountering considerable trouble in customer relations because the word "demand" appears on the face of the meter. It was pointed out that this was the demand of the customer on company-owned facilities, but that meters were commercially available which did not show this word on the face of meter or register. After considerable discussion, it was agreed the standard should remain in the present form and the matter tabled.

L. G. Eaton reported for G. A. Palmer that work was progressing slowly but satisfactorily in regard to revision of the Metermen's Handbook.

W. J. Piper said he was continuing to explore the trends in distribution systems which would cause changes in meter requirements. He said a definite trend was developing in meter reading and billing methods leaning towards more extensive use of electronic computers.

A survey showed that 10 companies require that the customer furnish and install the meter socket, whereas 44 companies furnish and retain ownership of the meter socket.

G. B. M. Robertson reported that MSJ-7, Standards for Watthour Meter Sockets, had been completed and printed by EEI. He said copies were available from this source.

F. A. Bell presented a report showing trends in service entrance requirements used by various operating companies. The trend seems to be following the same general area as heretofore with perhaps a litle more attention to mobile houses.

W. H. Farrington commented that modern meters now being manufactured could be provided with certain minor improvements and then permanently hermetically sealed. He suggested that manufacturers and users collaborate in design of a less expensive meter having satisfactory characteristics and permanent sealing. It was agreed that this subject will be given further study.

J. S. Lineback reported on recent activities of the Research Projects Committee.

A. W. Rauth presented a memory book to C. L. Hockman as a remembrance of his long association with the committee. A memory book was given to T. M. Faulk for presentation to E. P. Hodges.

G. B. M. Robertson, Chairman of the AEIC-EEI-NEMA Joint Committee, advised the group on the present status of all joint standards.

Electrical System and Equipment Committee Meeting

- *Electrical Features of Northlake Station*
- *New Developments of Current Interest*
- *Interconnected Operations of Texas Systems*

R. G. MEYERAND
Chairman

THE Electrical System and Equipment Committee held its 81st meeting at the Baker Hotel in Dallas, Texas, May 16-17, with approximately 125 members and guests attending.

Papers, Reports, Discussions

The program consisted of papers, reports, and discussions under the sponsorship of F. J. Berger, Chairman of the Subcommitte on System and Equipment Troubles; K. L. Wheeler, Chairman of the Subcommittee on Equipment and Station Design; R. M. Pennypacker, Chairman of the Subcommittee on Equipment and Station Operation and Maintenance; N. C. Storck, Chairman of the Subcommittee on System Engineering and Operation; A. P. Fugill, Chairman of the Sys-

tem Planning Subcommittee; and V. J. Hayes, moderator of the round table discussion.

On Monday morning the closed session program of the Subcommittee on System and Equipment Troubles was presented. Various system disturbances and apparatus failures were informally discussed by the committee and guests.

On Monday afternoon, in closed session, Mr. Wheeler of The Cleveland Electric Illuminating Co. presented a report on the activities of the Transformer Noise Committee. A meeting of this EEI-NEMA group will be held in the near future at which time it is hoped any differences of opinion will be resolved and a program of action initiated.

A round table discussion of subjects of general interest which had been submitted previously by members was held in closed session for the rest of Monday afternoon. Mr. Hayes was the moderator for this discussion period.

On Tuesday morning, under jurisdiction of the Subcommittee on Equipment and System Operation and Maintenance, Mr. Pennypacker, through J. M. Asmann, sponsored a paper on "Substation Maintenance and the Maintenance Dollar," by R. F. Stuart of Pacific Gas and Electric Co. This paper, which will appear in the September, 1960, EEI BULLETIN, points out that the cost of maintenance can be substantially reduced by work programming and more efficient use of personnel.

Mr. Wheeler, Chairman of the Subcommittee on Equipment and Station Design, sponsored three reports and a paper for his subcommittee.

A. F. Phillips of Duquesne Light Co. presented the "Progress Report of the Task Force on Power Fuses." A task force of the Electrical System and Equipment Committee, consisting of R. A. Lamley, R. R. Peatfield and Mr. Phillips, has reviewed the comments of the committee on the fourth draft of the C37 Standard for High-Voltage Fuses. These suggestions have been referred to the ASA Subcommittee for consideration.

J. H. Vivian, Southern California Edison Co., reported on "Activity of the ASA C76 Sectional Committee on Bushings." During the past year work on the revision of ASA C76.1-1943 has been carried on in AIEE by a joint working group of the AIEE Transformer Dielectrics Test Subcommittee and the AIEE Power Circuit Breaker Subcommittee. The AIEE draft will be reviewed and consolidated with the NEMA draft for publication as an ASA standard.

T. D. Reimers of Consolidated Edison Co. of New York, Inc., reported for the Lineless Wiring Diagram Working Group. It is the intention of the working group to determine the number of types of such diagrams, to obtain user opinion and to recommend to the manufacturers various suggestions to be considered in making a final standard agreeable to all concerned.

J. Q. Wray sponsored a paper by P. G. Brittain of Dallas Power & Light Co. covering "Electrical Features of North Lake Steam Electric Station." The terrain of the selected site was suitable for the construction of a pumped storage reservoir for the cooling water supply. The make-up water for this 800-acre lake is pumped 2¼ miles through a 42-inch concrete pipeline.

Outdoor Installation

The unit is an outdoor installation rated at 175 mw. The turbine is a tandem compound, double-flow, single-reheat machine. Throttle steam conditions are 1800 psig with reheat steam conditions at 502 psig, 1000 F. The generator is hydrogen cooled and rated at 176.8 mw, 221 mva at 30 psig hydrogen, 0.8 pf and generator voltage is 13.8 kv.

The generator is unit-connected to the main transformer with field-fabricated, micarta-covered generator leads. Segregated phase construction is used beneath the generator pedestal and consists of a structural aluminum framework with transite siding and interphase barriers. In this area the generator leads are extruded aluminum channel, 11 inches square. Expansion terminals connect this channel to the micarta-covered, 12¾-inch aluminum tubing used for the outdoor portion of the leads.

The three-phase, main power transformer is rated 200 mva, FOA, 13.2/132 kv with taps to 146.4 kv. System grounding practices permit a one-step reduction in insulation level to 550 kv BIL and 121-kv lighting arresters are tank-mounted. An oil-operated, fault-pressure relay is installed for alarm only and is the first of this type on the system.

Auxiliary power is supplied at 4160 volts and at 480 volts. The low-voltage neutrals of both the standby and unit auxiliary transformers are high resistance grounded through distribution transformers. This auxiliary grounding system is expected to prevent transient over-voltages during ground fault conditions, and still permit continued operation with a single fault until the fault can be located and repair scheduled.

Indoor 4160-volt switchgear is installed beneath the generator pedestal. The pedestal is enclosed and electrically heated to provide protection for this gear, as well as for the excitation cubicles. The 480-volt power center controls the larger 480-volt motors and provides feeders to several other motor control centers at various locations. Where building protection is not available, these centers are installed in walk-in type outdoor housings.

Live Transfer System

During the normal start-up procedures the auxiliary load is manually transferred from the standby to the unit transformer by paralleling the two sources. Under emergency conditions the standby and unit transformers are paralleled, and when the standby breaker closes the unit breaker will then trip. This latter live transfer system has been operated successfully several times during trial operation.

Control systems are designed for operation and supervision of four units from a central control room. Instrumentation, relaying, and controls for the boiler, turbine, generator, auxiliaries, and transform-

ers are concentrated on a single control board. This bench-type BTG board utilizes low-pressure pneumatic, and low-voltage systems for all control and metering functions. Two separate intra-plant communication systems are installed—a dial telephone service and a transistorized paging and party line system. The latter system uses compact, transistorized amplifiers at each speaker and handset station as a contrast with the previous installations of large, centrally located amplifiers.

The 138-kv switchyard is designed for double bus operation. The generator bay is equipped with two oil circuit breakers, permitting the generator to feed either or both busses. Bus conductors are four-inch, EHPS aluminum tubing and all switchyard structures are galvanized steel. No lightning arresters are installed in the switchyard since each 138-kv transformer has integrally mounted 121-kv arresters.

While the climate in the Dallas area permits outdoor plant installations, equipment and piping are occasionally exposed to sub-freezing temperatures. Gage lines and piping are protected by the application of nichrome heating wire with taped teflon insulation and a glass braid covering. Motors, switchgear, and instrument boards have resistance-type space heaters for anti-freeze protection and to prevent condensation from rapid temperature changes.

Minimum construction costs and lower operating expenses were achieved in the design of the North Lake Steam Station.

W. B. Fisk of Consolidated Edison Co. of New York, Inc., reported on the progress of the research study on direct conversion of energy to electricity. The study has as its objective the evaluation of the various methods of accomplishing this conversion. A preliminary report is scheduled for completion in June and this document will be transmitted to the sponsoring committees.

Mr. Fugill, Chairman of the System Planning Subcommittee, reviewed the activities of this subcommittee during the past two years. The group has issued various reports and surveys.

New Developments

The new developments part of the meeting followed under the sponsorship of Mr. Hayes.

K. N. Reardon of West Penn Power Co. discussed the "Brushless Excitation System" being used by his company. The system consists of an a-c exciter and a rotating silicon diode rectifier assembly mounted on the same shaft as the a-c turbine-generator field. The a-c exciter's rotating armature output is fed along the shaft to the rotating rectifiers, the output of which in turn is fed to the field of the a-c turbine-generator.

J. H. Vivian of Southern California Edison Co. presented a short report on "Remote Control of the Two-Unit 150-Mva Mammoth Pool Power Plant by Supervisory Control Via Microwave and Closed Circuit Television." Sound monitoring of the plant and closed circuit television aid the remote operator at the supervisory control room.

C. H. Rohe of Pennsylvania Power & Light Co. presented a report by P. Holtz on "An SF-6 Gas Insulated Circuit Breaker." This 230-kv, 1600-amp breaker is scheduled for service in August, 1960. The Pennsylvania Power & Light Co. has had experience with other SF-6 gas insulated equipment and the good past operating record is encouraging for further utilization of SF-6 gas.

L. K. Del'Homme of Houston Lighting & Power Co. read a report, "Unique Cathodic Protection Installations," prepared by D. E. Simmons. Due to the varied water conditions both in composition and resistivity an applied external voltage system was used. It is expected that automatically regulated constant current rectifiers and new anode materials will result in more satisfactory operation and longer life than is obtained with conventional equipment.

T. D. Reimers of Consolidated Edison Co. of New York, Inc., spoke on "Automatic Data Logging Equipment" to be used as part of the supervisory control systems for substations. The data required will be automatically logged on punched tape instead of tabulated forms.

Intersystem Power Pool

Mr. Storck, Chairman of the Subcommittee on System Engineering and Operation, sponsored a paper through H. E. Stites, en-

(*Continued on page* 277)

Insurance Committee Meeting

- *Nuclear Insurance, Government Indemnity*
- *Report on Mutual Assistance Problems*
- *Development in the 'Umbrella' Field*

R. R. MacKAY, JR.
Chairman

THE annual spring meeting of the EEI Insurance Committee was held at Longfellow House, Pascagoula, Miss., on April 27-29, with 37 members and guests attending.

R. D. Constable, Chairman of the Subcommittee on Employee Benefits, discussed current trends in the group insurance field, particularly the trend of rising costs of medical care.

C. R. Garton, Chairman of the Subcommittee on Fire Protection, reported on the group's activity in the various phases of electric utility property protection which had been assigned to the subcommittee for

consideration. He also presented the results of a study by the Task Force on Fire Protection and Prevention Practices.

J. V. Anderson, Chairman of the Subcommittee on Nuclear Projects, presented a detailed report summarizing recent proposals for nuclear liability insurance rating and outlining the recent AEC regulations pertaining to the field of both nuclear insurance and government indemnity.

W. O. Randlett, Chairman of the Subcommittee on Fire and Allied Lines, summarized the results of a preliminary meeting between this subcommittee and the Inter-Regional Insurance Conference at which further fire insurance rate credits were discussed. As a result of general committee discussion several suggestions were given to the subcommittee for further discussion and review with the Inter-Regional.

A. L. Benjamin, Chairman of the Subcommittee on Industry Practices, submitted a current and revised report summarizing general insurance practices of various member companies. He further advised that the subcommittee would prepare itemized data on the practices of member companies regarding the type of insurance coverage and limits carried against fidelity and burglary losses.

J. W. Marrin, Chairman of the Subcommittee on Mutual Assistance, advised that this subcommittee had prepared a report describing the insurance and liability problems which can potentially arise through interchange of employees under the mutual assistance program and stated that this report would be sent by the Institute to all member companies.

H. S. Downing, Chairman of the Subcommittee on Liability, reported briefly on current developments in the field of liability insurance and also presented a résumé of so-called "umbrella" insurance, a type of excess liability insurance designed to insure all liability risks, both known and unknown.

The meeting concluded with a general discussion of recent losses which were felt to be of interest to the committee.

The next meeting of the committee will be held Oct. 24-26 at the French Lick-Sheraton Hotel, French Lick, Ind.

Accident Prevention Committee Meeting

- *Frequency Rate Improves*
- *New Films Available*
- *Closed Chest Heart Pump*

A. J. NAQUIN
Chairman

THE EEI Accident Prevention Committee held its 69th meeting in St. Petersburg, Fla., April 24-27, with 116 members and guests in attendance. The committee met at the Colonial Inn-Desert Ranch, St. Petersburg Beach.

R. J. McCutcheon, Jr., Senior Member, Board of Directors, Florida Power Corp., welcomed the members and guests.

S. H. Young, Committee Vice Chairman, reported that the industry frequency had reached an all-time low of 6.06 disabling injuries per million man-hours worked. However, severity had increased, principally because of the increased number of fatal injuries during 1959. He reiterated that "continued proximity to unprotected parts will eventually result in contacts which have a high percentage of fatal results."

In his report on electric shock and burn accidents Errol Dunbar pointed out that "although Dr. Kouwenhoven has assured us that low voltage produces fibrillation and is a killer almost impossible to combat, many of our companies do not insist on the use of protective equipment on low voltages."

The Aerial Basket Subcommittee headed by Mr. Lorenz submitted a report for review.

In his luncheon address F. S. Black, Vice President, Administrative, Tampa Electric Co., emphasized that to meet the challenge of change in the electric utility industry by increasing the number of employees was not enough. "What we need to do is to hire men who are smarter than we are and give them far more training than we had," he pointed out.

H. B. McMahan reported that the 1960 safety package program has been completed and work has been started on the 1961 package.

The Protective Equipment Committee, under the leadership of C. A. Coutts, will continue to review and make recommendations with respect to the AP 1 Specifications for Electrical Workers Head Gear. This subcommittee will also review and bring up to date recommendations for the care and application of linemen's protective equipment.

John Gronbeck reported that there are a number of new films available. Among these are "Cause Undetermined," a 16mm color motion picture emphasizing the "familiarity-breeds-contempt" idea as applied to a line situation. This film was sponsored by a group of six New England companies.

"KV Shell Game," a 35mm color, sound-slide film on the mechanical protection offered by the safety hat, was shown.

"Powerful Protection," describing hard-hat electrical protection, a sound-slide film, is available.

J. B. Hamblen in his presentation address, "A Balanced Safety Program," reviewed the basic elements of a good safety program. Among his conclusions was that safety is the result of expert management.

In his report on resuscitation Dr. Kouwenhoven commented that the heart has its own center which causes it to beat 100,000 times a day. A small current (for some reason at present unknown) can cause an up-

set in this center, which results in fibrillation during which no blood is pumped through the system. In the event that a person is unconscious, if there is pulse, the mouth-to-mouth method of resuscitation should be applied so as to get oxygen into the blood. If there is no pulse, the heart might be either in standstill or fibrillation. If it is in fibrillation the only reliable method is to use the counter shock defibrillator. A number of tests on anesthetized dogs indicated that it is important to successful recovery that the heart not be allowed to remain in fibrillation longer than absolutely necessary. The number of successful recoveries decreases rapidly after the first minute. The portable defibrillator has been successfully used on humans a few times with no equipment troubles. It is still being tested.

Guy Knickerbocker reported on experience with the closed chest method of maintaining blood circulation. It consists of placing the heel of one hand at the end of the breast bone, placing the other hand on top and pressing forcibly about 60 times a minute. Some air is moved in this method. It also keeps the heart in good condition to receive stimuli. It causes the heart to pump blood which nourishes the brain. There have been a number of cases in the hospital where the closed chest method has maintained circulation for a period of from 10 to 20 minutes while the defibrillation equipment was obtained and made ready. In almost every case the closed chest method has maintained the patient in good condition.

Rescue Breathing

William Bremner presented a rescue breathing retraining film which is available and James Thompson showed a method whereby one operator could perform rescue breathing on two victims.

Paul Sheppard, reporting on National Safety Council activities, showed the new film, "Safety Everywhere All the Time," which is now available as part of a program.

The committee expressed its appreciation to Mr. McMahan and his associates for the fine arrangements which contributed so much to a successful meeting.

Transmission & Distribution Committee Meeting

- *Training Underground Crew Leaders*
- *Duquesne's Urban Redevelopment Program*
- *Pacific G&E's Line Truck Power Equipment*

H. E. CODY
Chairman

THE spring meeting of the Transmission and Distribution Committee was held May 12-13 at the Penn-Sheraton Hotel, Pittsburgh, Pa. W. A. Conwell, Vice President-Engineering and Construction, Duquesne Light Co., welcomed the 205 members and guests to Pittsburgh.

Underground

The opening session was sponsored by D. F. Tulloch, Chairman of the Underground Subcommittee.

T. E. Starrs described Public Service Electric and Gas Co. application of limiters on 277/480Y-volt spot networks. Silver-sand limiters, which will clear large fault currents rapidly without venting ionized gas, are used to isolate the main bus if a fault occurs on transformer secondary leads, the main bus or the service leads.

W. H. Meade told how the Boston Edison Co. has modified 4-kv, 300-amp underground oil switches to increase their 10-cycle short circuit current capability from 10,000 to 25,000 amperes. This is accomplished by a simple alteration of the bridging member requiring two manhours.

H. L. Davis, Jr., announced that the 1958 Cable Operation Report has been completed. Data from the major users of paper and lead duct-lay cable, 7.5 kv and above, show a trouble rate of 8.4 per 100 cable miles in 1958 as compared with 7.6 in 1957. As usual mechanical damage was the principal cause of trouble.

J. A. Pulsford reported that balloting on the proposed revision of EEI-NEMA Standards for Secondary Network Transformers indicates the need for a further change in the manner of designating the standard primary voltage ratings.

H. B. Shea described Boston Edison's training program for underground crew leaders. Five half-day sessions for groups of five or six leaders are devoted to improving leadership qualities and promoting more effective use of manpower, tools and equipment through thorough job planning and proper individual work assignments.

General Engineering

C. E. Bathe, Chairman of the General Engineering Subcommittee, sponsored a session covering a variety of subjects.

H. L. Williams reported that the Research Activities Task Force is continuing to review transmission and distribution problems to determine those on which further research appears desirable. Three items recommended for further study include epoxy resins for cable joints and terminations, synthetic insulation for extra high voltage cable and the mechanism of lightning flashovers.

K. W. Klein described an economic study of distribution transformer losses by The Cleveland Electric Illuminating Co., indicating that the optimum copper-to-core loss ratio is substantially lower than the 3.5 value typical of present designs. He suggested the need for an industry wide study of the subject.

T. C. Duncan reported that NEMA has rejected the recommendations of the preliminary report of the EEI-

NEMA Joint Committee on Higher Secondary and Utilization Voltages.

H. L. Murphey, Jr., discussed Duquesne Light Co. experience with urban redevelopment in Pittsburgh during the past 12 years. Relocation costs of recent projects have been reduced very substantially by establishing closer liaison with the city planning agencies so that problems could be worked out to the best mutual advantage in the early stages of planning.

F. E. Johnson urged cooperation in returning a questionnaire eliciting power company experience with single-phasing of three-phase motors. This is part of a nationwide survey being conducted by Underwriters' Laboratories on behalf of National Electrical Code Panel 11 to determine the extent of the problem and permit evaluation of the need for three-element protection of three-phase motors.

The remainder of the afternoon was devoted to a closed session on General Engineering Subcommittee matters.

Overhead

The opening session on the second day was sponsored by R. Hicock, Chairman of the Overhead Subcommittee.

C. R. Machen described power equipment added to Pacific Gas and Electric Co. line trucks which has permitted a decrease in crew size from six to four men. This equipment includes hydraulic derricks, truck jacks and pole pullers and a built-in air compressor with air impact wrenches, tampers and spades. Other powered equipment now in use includes hydraulic derrick-mounted pole diggers, line stringing and removal equipment and aerial ladders and trucks.

R. D. West told how Duquesne Light Co. plans to convert most of its 69-kv transmission system to 138 kv at less than half the cost of new lines. One important factor is the use of strut insulators which permit a substantial increase in insulation level without extensive structural changes in the towers. R. G. Anderson then described a tower jack designed to raise towers in place as much as 26 feet without circuit interruption. Although useful in connection with the 69 to 138-kv conversion, the jack was designed originally to raise towers in congested areas where clearance encroachments had developed.

Prof. R. N. Jorgensen reported that Pennsylvania State University has not been able to devise any reasonably economical means of protecting poles from pileated woodpeckers to date. Tests of 175 chemicals has failed to reveal any effective repellent.

F. A. Ashbaugh reviewed progress in chemical control of right-of-way since its inception about 13 years ago. Developments in chemicals, spray solutions, application techniques and treating schedules now provide for a chemical control program which costs less than half of equivalent maintenance by purely mechanical means.

D. A. Campbell, Jr., described refinements of the storm tracking plan for companies along the eastern seaboard developed by the Mutual Assistance Task Force.

A report from W. S. Price noted that the research project on galloping conductors now is underway at the Massachusetts Institute of Technology.

Standards and Specifications

H. G. Hally, Chairman of the Standards and Specifications Subcommittee, called on task force chairmen for reports of their activities.

A. T. Green reported favorable letter ballots on a proposed supplement to EEI-NEMA standards for street lighting poles and a proposed new standard for light sensitive control devices. Work on a proposed revision of existing standards for filament lamps is nearing completion.

H. C. Bingham announced that the proposed "Application Guide for Automatic Oil Circuit Reclosers" received a favorable letter ballot and is being released for printing.

F. G. Josberger reported that drafts of proposed EEI-IPCEA specifications for three varieties of No. 4 aluminum overhead service cable are about ready to be submitted to members for comment.

C. E. Topping stated that the proposed new specification for insulated clevises has been submitted to members for ballot. The EEI-NEMA Joint Committee on Pole Line Hardware is working on proposed new standards for secondary extension brackets and aerial cable hangers as well as revisions of several existing specifications.

W. H. Johnson announced that the proposed revision of TD-90 "Specifications for Douglas Fir Crossarms, Treated or Untreated" received a favorable letter ballot and is being released for printing. The Timber Products Task Force now has initiated work on a proposed guide for groundline treatment of poles.

(*Continued on page* 278)

Electrical System and Committee Meeting

(*Continued from page* 274)

titled "Interconnected Operations of Power Systems in Texas." This paper was prepared by J. M. McReynolds of Houston Lighting & Power Co.

The Texas interconnected systems are arranged into two pools, each having approximately the same loads and each serving geographical areas similar in size. Interconnected operation of the Texas systems has proven beneficial to all of the member companies. It has been possible for each system to reduce its spinning reserve requirements, maintain better frequency regulation during normal and emergency conditions, and improve service reliability.

The System Engineering and Operating Subcommittee, through H. A. McLaughlin, sponsored a paper, "Recent Practices and Trends in Protective Relaying," prepared by H. J. Sutton of Gulf States Utilities Co. Some of the latest trends in protective relaying were mentioned in a digest of this paper which had been presented previously by the AIEE Subcommittee on Survey of Relay Practices.

People in Power

P. O. CANADAY, Executive Vice President of Arkansas Power & Light Co., has been elected President of the utility. He succeeds R. E. RITCHIE, who has been re-elected Chairman of the Board and Chairman of the Executive Committee. REEVES RITCHIE, Personnel Director at Pine Bluff, was promoted to Vice President.

Mr. Canaday becomes the fourth man to serve as president of the state's largest power supplier. AP&L serves 296,000 customers in 61 counties.

Mr. Canaday is a veteran of 34 years in the electric power and light industry. He was graduated from the University of Tennessee with an electrical engineering degree in 1926. He had worked as a part-time student engineer for Tennessee Public Service Co. During 12 years with Tennessee Public Service, Mr. Canaday served in various engineering and management positions. Leaving Knoxville in 1938, he worked as an utility consultant in New York City for six years.

Since 1944, he has been affiliated with AP&L and the associated electric utilities in the Middle South system.

Reeves Ritchie was elevated to an officer of the company after 23 years' service, which he began as a mechanic's helper at the Little Rock power plant. From 1945-51, he served as assistant personnel director in Pine Bluff. After working from 1951 to 1958 as assistant to the central division manager in Pine Bluff, he was promoted to personnel director in August of that year.

Mr. Ritchie is a past president of

P. O. CANADAY

the Arkansas Junior Chamber of Commerce and past president of the Pine Bluff Boys' Club.

FRANK KITZMILLER, JR. has been appointed to the new position of Inter-Industry Coordinator for the Live Better Electrically Program of EEI, RALPH ZEUTHEN, Manager of the program, has announced.

Mr. Kitzmiller's experience includes service with Duquesne Light Co. in Pittsburgh, and 12 years with EEI. He has been a key figure in all of the LBE activities as the senior member of the LBE staff.

T & D Committee Meeting

(*Continued from page* 277)

A report from R. J. Bentzel indicated a favorable letter ballot on the proposed revision of EEI-NEMA Standards for Distribution Transformers—Overhead Type.

J. R. Guy presented results of an analysis of inventory costs being conducted by The Cleveland Electric Illuminating Co. and emphasized the value of standardization in keeping these costs at a reasonable level.

The closing session, sponsored by H. W. Dannettell, Jr., Chairman of the Safety Subcommittee, featured discussion of increased safety by insulation of the lineman from ground contacts.

C. U. Thomas described new vertical clearance on poles recently established by Duquesne Light Co. following a study of linemen's physical dimensions and normal working position on the pole. The revised clearances are designed to provide a minimum clearance of six inches between the lineman's feet and any grounded equipment.

M. H. Thurmond discussed Potomac Edison Co. experience with the use of pole-mounted insulating platforms. These platforms have been used to maintain 12-kv lines for 25 years without any record of an electrical contact accident.

Dollar Savings in Fire Insurance Valuations

(*Continued from page* 256)

for starting and testing equipment and for factory inspection are included in this category. However, charges for expediting delivery should be considered insurable only to the extent that such expediting work is required under normal procedures. In other words, if the expediting expenses are for speeding up deliveries beyond the usual requirements they should be excluded.

15. Repairs and replacements made during the normal course of operation or use of property should be considered insurable only to the extent that they improve the property. For example, if a worn floor in a building is replaced by a new floor of similar construction, the proportion of the cost of removing and replacing the old floor which should be considered insurable would be the amount by which the old floor had been depreciated. If the old floor were replaced by a better type of floor, an additional amount should be added to cover the difference between the current costs of the old and new type floor.

All of the foregoing items indicate that, while there is plenty of room for discussion or disagreement, a very considerable portion of original costs may be eliminated in the determination of the amount of insurance required, or necessary to be carried. A careful consideration of the wording of the coverage and the exclusion costs incorporated in the contract, and an elimination of many of the charges entering into original costs that would not be reincurred in event of property replacement, may effect appreciable dollar savings in fire insurance valuations.

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Residential Appliance Promotion, H. R. NYE.....Western Massachusetts Electric Co., West Springfield, Mass.
Residential Electric Heating & Air Conditioning, C. E. ANDERSON..Virginia Electric and Power Co., Richmond, Va.
Residential Lighting Promotion, R. W. SCHMIDT.....Indianapolis Power & Light Co., Indianapolis, Ind.
Residential Wiring Promotion, J. F. ROBERTS.....Philadelphia Electric Co., Philadelphia, Pa.
Advertising, O. K. LEBLANC.....Louisiana Power & Light Co., New Orleans, La.
Area Development, [illegible] P. LEE.....The Connecticut Light & Power Co., Berlin, Conn.
Electrical Living Policy, W. M. SHEPHERD.....Arkansas Power & Light Co., Little Rock, Ark.
Market Research, G. L. [illegible]ODN.....The Detroit Edison Co., Detroit, Mich.
Sales Personnel & Training, G. [illegible] STEFFEN.....Union Electric Co., St. Louis, Mo.

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